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14. ABSTRACT *(Maximum 200 words)*:

Five working papers dealing with design specification for (MPT)2: Product 1, System performance requirements estimation aid; Product 2, Manpower constraints estimation and design specifications; Product 3, Personnel constraints estimation aid design specifications; Product 5, Manpower determination aid; and Product 6, Personnel requirements estimation and design specifications.

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Micro Analysis and Design, and Dynamics Research Corporation (1988). Product 2: Manpower constraints estimation and design specifications. WP MSG 88-06.

Micro Analysis and Design, and Dynamics Research Corporation (1988). Product 3: Personnel constraints estimation aid design specifications. WP MSG 88-07.

Micro Analysis and Design, and Dynamics Research Corporation (1988). Product 6: Personnel requirements estimation and design specifications. WP MSG 88-09.

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DESIGN SPECIFICATION FOR (MPT)2 PRODUCT 5

MANPOWER DETERMINATION AID

VOLUME I

Prepared By:

Micro Analysis and Design
and
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1 January 1988

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PRODUCT 5

MANPOWER DETERMINATION AID

SOFTWARE SPECIFICATION

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30 December 1987

PRODUCT 5: MANPOWER DETERMINATION AID

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PRODUCT 5: MANPOWER DETERMINATION AID

SECTION 1 - INTRODUCTION

1.1 OBJECTIVE OF PAPER

This paper contains the software design specifications for an aid for systematically estimating manpower requirements for Army weapon systems following the initial detailed interface design but prior to the decision to fund the hardware/software prototype. The Manpower Determination Aid (MDA) is one of six products being developed in the Army Research Institute's (ARI) Manpower, Personnel, and Training aids for the MANPRINT integration $(MPT)^2$ project.

The design specification describes requirements for this aid, and presents a detailed description of the aid's steps and the techniques for developing them. It also delineates the software design.

This design specification is the second step in a three-step development process. The first step was to develop a concept paper describing the functionality of the MDA in concept. In this second step, detailed design specifications have been developed. In the third step, software, documentation, and training for the aid will be produced and demonstrated.

NOTE: IT IS NOT THE INTENTION OF THIS SPECIFICATION TO PRESENT A DETAILED DISCUSSION OF THE CONCEPTS BEHIND THE MDA. FOR A DISCUSSION OF THE MDA CONCEPTS, REFER TO THE CONCEPT PAPER.

1.2 OVERVIEW OF (MPT)2 PROCUCTS

Figure 1 displays the six $(MPT)^2$ products and their expected role in the Army's new streamlined Materiel Acquisition Process (MAP). The first four products, the System Performance Requirements Estimation Aid, the Manpower Constraints Estimation Aid, the Personnel Constraints Estimation Aid, and the Training Constraints Estimation Aid, are designed to estimate MPT-related requirements and constraints during the Requirements/Technology Base Activities Phase of the MAP. These requirements and constraints will guide subsequent contractor design activities.

The System Performance Requirements Estimation Aid (SPREA) will help Army combat developers identify comprehensive and unambiguous system performance requirements needed to accomplish various missions.

The next three $(MPT)^2$ products are designed to determine MPT constraints. The Manpower Constraints Estimation Aid (MCEA) will identify the maximum crew size for operators and maintainers and the maximum Direct Productive Annual Maintenance Manhours (DPAMM) for maintainers. These constraints will be based on assessments of the manpower likely to be available to man the new system.

The Personnel Constraints Estimation Aid (PCEA) will estimate the significant personnel characteristics that describe and limit the capabilities of the probable soldier population from which the new system's operators and maintainers will come. The PCEA will identify the minimally acceptable boundaries for these characteristics.

The Training Constraints Estimation Aid (TCEA) will identify what the training program for the new system is likely to look like given current training practices in the field. It

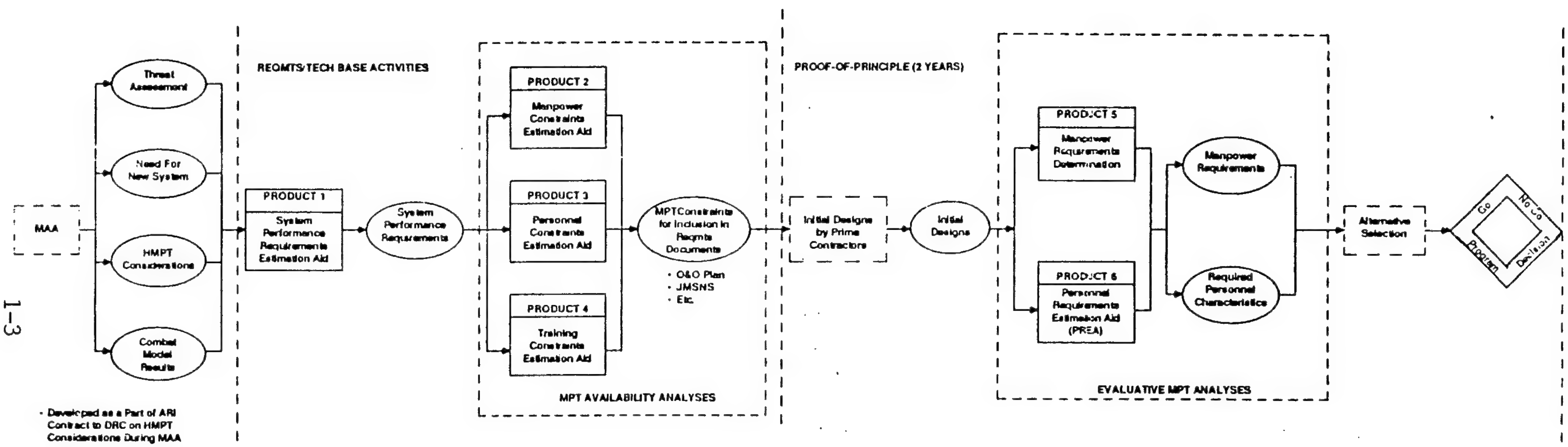

Figure 1. Expected Role of Six (MPT) [2] Products.

will also determine the maximum training time available to train the personnel given available training resources.

The last two products help evaluate initial contractor designs. The Manpower Determination Aid (MDA) and the Personnel Requirements Estimation Aid (PREA) are designed for use during the Proof of Principle Phase. They will be used after initial contractor designs have been submitted, but before one design is chosen to develop into a prototype. These products evaluate initial contractor designs and develop MPT alternatives that minimize personnel characteristic deficits (i.e., discrepancies between the type and number of people required and the number of these people likely to be available when the system is fielded).

The Manpower Determination Aid (MDA) determines the quantitative manpower requirements needed to support a contractor design by assessing the workload associated with the tasks that the contractor design specifies.

The Personnel Requirements Estimation Aid (PREA) determines the type and level of personnel characteristics needed to support the effective performance of each task associated with a contractor design.

Personnel characteristic requirements for individual tasks are then aggregated to produce estimated personnel characteristic requirements at the job or duty position level. These job requirements are multiplied by the quantitative manpower requirements to determine the total number of individuals with various levels of personnel characteristics that are required to support that design. The personnel characteristic distribution this analysis produces can then be compared with personnel characteristic constraints to identify deficits.

The results of these two evaluative aids will be used to select a specific design alternative for further development. As such, the results can be incorporated into higher level analyses such as the Cost and Operational Effectiveness Analysis (COEA). The PREA will provide MANPRINT analysts with the information needed to effectively make the "go/no go" decision at the end of the Proof-of-Principle Phase.

1.3 ORGANIZATION OF THE SPECIFICATION

The remainder of this specification paper is organized into four sections. The next section on product requirements includes the product's objectives, significant output, users, role in the acquisition process, assumptions, and the high-level functional requirements/constraints associated with it.

Section 3 describe in detail the software specifications for the two modules that make up the MDA; the Workload Assessment Aid (WAA) and the Maintenance Manpower Analysis Aid (MMAA). Included in this description is a step-by-step presentation of the user interface of the MDA.

The MDA will contain two types of files -- libraries which describe "hardwired" input data and working files that are used to store results related of a particular application. The working files will be used as input to the simulation models that will produce the output files for Product 5. Descriptions and data structures for these two types of files can be found in sections 4 and 5 of this specification. The description of the libraries also includes some of the actual values for the "hardwired" input data.

Section 6 describes, in detail, the simulation models that will be used in the MDA to determine manpower requirements.

Section 7 provides a discussion of the technology transfer issues that relate to Product 5. Included in this section are specifications for user and programmer documentation that will be produced for the Product 5 software.

SECTION 2 - PRODUCT REQUIREMENTS

2.1 OBJECTIVES

The purpose of the Manpower Requirements Determination Aid (MDA) is to determine the quantitative manpower requirements for a specific contractor's design. The MDA will be used during the Proof-of-Principle Phase, after the contractor submits the initial designs, but before one design is chosen to develop into a prototype. The Manpower Determination Aid's output will be used with the output from Product 6. The combined output will help develop manpower, personnel, and training (MPT) alternatives that minimize personnel characteristics deficits. These deficits are discrepancies between the type and number of people required and the number of such people likely to be available when the system is fielded.

2.2 MAJOR OUTPUT

The MDA will determine manpower requirements for each contractor design. These requirements will include: 1) the jobs associated with each design, 2) the tasks associated with each job, and 3) the number of operators or maintainers in each job. In addition to defining manpower requirements by job or duty position, the MDA will be capable of assigning each job to an MOS, and calculating total manpower requirements by military occupational specialty (MOS), skill level, major component item (for maintainers only), and maintenance level (for maintainers only).

In addition to producing manpower requirements estimates, the MDA will have the capability to estimate system availability, reliability, and operational effectiveness. We will compare these estimates with the requirements that the System Performance

Requirements Estimation Aid (Product 1) identified during the Requirements Technology Base Activities Phase of the Materiel Acquisition Process (MAP). This comparison can identify shortfalls (discrepancies between requirements and estimates based on contractor design).

2.3 ROLE OF PRODUCT 5 OUTPUT IN ACQUISITION PROCESS

During the acquisition process, manpower requirements for an emerging system are described primarily in two documents. These documents are the basis-of-issue plan (BOIP) and the qualitative and quantitative personnel requirements information (QQPRI) documents. This section explains how these documents present quantitative manpower requirements, where the information comes from, and who is responsible for this information.

The MDA will be designed to provide input to these two documents.

BOIP

The BOIP:

"States the number of new or improved items of equipment and personnel to be included in Tables of Organization and Equipment (TOE) Level 1 (100 percent wartime requirements), Tables of Distribution and Allowances (TDA), Joint Tables of Allowances (JTA), Additive Operational Projects (AOP), and TDA Augmentation to Modified Tables of Organization and Equipment (MTOE) when directed by HQDA." (Revised AR 71-2, Section 1-5)

The BOIP must justify the Manpower requirements it includes by clearly stating:

> "The rationale considered in determining the type and number of items and personnel needed to support the principal item (QQPRI, operator and maintainer decision). Personnel increases exceeding requirements document estimates will be justified or trade-off assessment completed." (Section 5-9)

The Deputy Chief of Staff for Operations and Plans (DCSOPS) is the Army staff proponent for the BOIP system.

<u>QQPRI</u>

The revised AR 71-2 describes:

> "The QQPRI...[as] a compilation of organizational, doctrinal, training, duty position, and personnel information. It is prepared for a new or improved item of equipment by the materiel developer in coordination with the combat and training developer...The QQPRI is used as follows:
>
> (1) To determine the need to establish or revise a Military Occupational Specialty (MOS), Specialty Skill Identifier (SSI), and civilian OPMCS.
>
> (2) To prepare plans to provide the personnel and training needed to operate, maintain, and transport the new or improved item of equipment.
>
> (3) As a source document for direct productive annual maintenance manhours (DPAMMH)."

Figure 2 presents the QQPRI format. One of the QQPRI's key components is the DPAMMH:

> "[The] DPAMMH will be based on the empirical data or, as a minimum, estimated hours will be submitted and so identified for all developmental items of equipment or system. Hours will be expressed by MOS, SSI, and OPMCS for each category of maintenance (UL, IDS, IGS, AVIM, AVUM). When LSA data or engineering estimates are sources for DPAMMH, the annual usage rate used in the computation should be provided. This annual usage rate should be a derivative of equipment mission profile found in the appropriate materiel need document." (Section 4.8)

According to AR 71-2, the QQPRI also presents:

> "The number of direct operators needed to make up a crew or operate the system as a single shift and a listing of duty positions, by descriptive title, required for operation and maintenance of the equipment. [It also contains] a suggested placement of duty positions within a current, revised, or new commissioned officer SSI, or warrant officer or enlisted MOS, special qualification identifier (SQI), ASI, or civilian OPMCS.
>
> A listing of the individual system unique duties and tasks to be performed in each of the above identified positions requiring new, revised, or current MOS, SSI and OPMCS. Other special characteristics (e.g., a certain height to operate equipment, a security clearance required to operate or maintain the equipment

TITLE: The title of the QQPRI will identify the type of QQPRI, the title of the principal item, the LIN, PIP number, and the new equipment training plan (NETP number). This same title will be used on all correspondence forwarding the QQPRI through channels. Note: Once TRADOC assigns the BOIP number, the number(s) will be included in all subsequent correspondence.

1. **REQUIREMENT INFORMATION:**

   a. Requirement or Procurement Directive:
   b. Type Classification (TC) date:
   c. First Unit Equipped date (FUED):
   d. Army Modernization Information Memorandum (AMIM) Number: (Note 1)

2. **DESCRIPTION AND DIRECT PRODUCTIVE ANNUAL MAINTENANCE MANHOURS (DPAMMH):** (Notes 2, 3, 4, and 5)

   a. Principal Item:
   b. Component Major Item:
   c. Total DPAMMH by MOS, SSI, or OPMCS for subparagraphs a and b above:
   d. Associated Support Items of Equipment (ASIOE):

3. **NUMBER DIRECT OPERATORS REQUIRED TO CREW OR OPERATE EQUIPMENT:**

4. **DUTY POSITIONS BY DESCRIPTIVE TITLE:**

5. **INDIVIDUAL UNIQUE DUTIES, TASKS, AND CHARACTERISTICS:** (Notes 6 and 7)

6. **NETP NUMBER AND NET TRAINING BASE REQUIREMENTS:** (Notes 1 and 8)

(Enclosures - Draft Job Specifications)

Note 1. Use "NA" for paragraphs 1d and 6 when not applicable.

Note 2. The format subparagraphs a through d above will appear on all QQPRI. This format is very flexible to use on the four subparagraphs (a-d) or can be expanded by using "high school outline" to accommodate major systems, or multiple LIN under each subparagraph (a, b, and d).

Note 3. Materiel developers will identify LIN, nomenclature, description, levels of maintenance (UL, IDS, IGS, AVIM, AVUM), MOS, SSI, and civilian OPMCS. Materiel developers will always provide DPAMMH for the principal LIN and the component major items whether they are type classified or not. Additionally, the materiel developers will provide DPAMMH for all ASIOE that have developmental items. For type classified ASIOE, the materiel developer will list the LIN and nomenclature only. DPAMMH will be based on the empirical data, or as a minimum, estimates will be submitted and so identified. DPAMMH should represent the maintenance burden generated by one item of equipment during one year. When LSA data or engineering estimates are sources for DPAMMH, the annual usage rate used in the computation should be provided. This annual usage rate should be derivation of equipment mission profile found in the appropriate materiel need document. Usage of "Note" to explain information or rationale is encouraged.

Note 4. Formatting for each LIN under the subparagraph a and b including the type of equipment is below. MCI will be subdivided by developmental item(s) and type classified item(s); show NSN or PN for all CMI.

Figure 2. QQPRI Format.

LIN, Generic Nomenclature, Description (for TMDE start the description with the term "TMDE" and include Central TMDE Activity (CTA) approval number)

MOS/SSI/OPMCS UL IDS IGS

Note 5. Subparagraph c is to be calculated on the basis of one principal item and any CMI in required quantities. Formatting will be:

MOS/SSI/OPMCS DPAMMH

Note 6. Paragraph 5 above:

a. Do not include skills. The SGA determines the skill level.

b. Include MOSs that support the maintenance levels of all ASIOE.

c. For aviation equipment, include any ground maintenance that is not authorized in AVUM/AVIM, but are at the UL, IDS, and IGS level of maintenance.

Note 7. Paragraph 5 above:

a. If the duties and tasks listed in AR 611-101, AR 611-112, or AR 611-201 are adequate, use the following for each MOS or SSI:

FOR COMMISSIONED OFFICERS:

SSI. . . (indicate any SQI here) performs duties and tasks as listed in AR 611-101.

FOR WARRANT OFFICERS OR ENLISTED:

MOS. . . (indicate any ASI or SQI here) performs duties and tasks as listed in (AR 611-112, AR 611-201).

b. If the duties and tasks listed in AR 611-101, AR 611-112, AR 611-201 do not include the system unique duties, tasks, or characteristics, use the following for each MOS and SSI:

FOR COMMISSIONED OFFICERS:

SSI. . . (indicate any SQI here) . . . . (indicate system unique duties, tasks, characteristics). Other duties and tasks are listed in AR 611-101.

FOR WARRANT OFFICERS OR ENLISTED:

MOS. . . (indicate any ASI or SQI here). . . . (indicate system unique duties, tasks, characteristics). Other duties and tasks are listed in (AR 611-112 or AR 611-201).

c. If the duties and tasks in AR 611-101, AR 611-112 or AR 611-201 need to be revised, use the following for each MOS and SSI:

Figure 2. QQPRI Format (Continued).

FOR COMMISSIONED OFFICERS:

Revised SSI. . . (indicate any current or new SQI here). Draft proposed job specifications are attached at enclosure. . . . Other duties and tasks are listed in AR 611-101.

FOR WARRANT OFFICERS OR ENLISTED:

Revised MOS. . . (indicate any current or new ASI or SQI here). Draft proposed job specifications are attached at enclosure... . Other duties and tasks are listed in (AR 611-112, AR 611-201).

d. If a new MOS, SSI, ASI, or SQI will be required for AR 611-101, AR 611-112, or AR 611-201, use the following for each MOS and SSI:

FOR COMMISSIONED OFFICERS:

New SSI. . . (indicate any SSI here). Draft proposed job specifications are attached at enclosure. . .

FOR WARRANT OFFICERS AND ENLISTED:

New MOS. . . (indicate any ASI or SQI here). Draft proposed job specifications are attached at enclosure. . . .

Note 8. Provide the following for Paragraph 6:

a. NETP number (if none, so state).

b. UIC, quantity, LIN, nomenclature and justification for any NET Training Base requirements.

Figure 2. QQPRI Format (Continued).

The combat developer within the TRADOC proponent school has primary responsibility for developing the BOIP and QQPRI. The Program Manager within the Army Materiel Command (AMC) subordinate command provides input to the combat developer. DCSOPS processes and approves both the BOIP and QQPRI.

The latest version of AR 71-2 recognizes that the Army HARDMAN methodology, as the Army's current manpower determination aid, feeds the BOIP/QQPRI data. But AR 71-2 also leaves room for additional DCSPER-approved methodologies:

> "The results of hardware vs. manpower (HARDMAN) methodology or an approved DCSPER methodology will provide source data for the BOIP and QQPRI process." (Revised AR 71-2, 10 Oct. 1986, p. 10)

The MDA will probably become one of the additional methodologies cited in AR 71-2. By systematically assessing workload, the MDA will provide more accurate estimates of manpower requirements, particularly operator requirements.

<u>Manpower Assessment in Support of Requirements Documents</u>

The Letter of Agreement (LOA) and Required Operational Capability (ROC) both have sections that require reporting the results of a "manpower/force structure assessment." TRADOC/AMC PAM 70-2 describes this assessment as follows:

> "Manpower/Force Structure Assessment. Estimate manpower requirements per system, using unit, and total Army by component (Active, ARNG, USAR). Identify manpower savings resulting from replaced systems, if any. Include a statement to require an assessment of

alternatives to reduce manpower requirements and an assessment of force structure implications resulting from system inclusion in the total force by component.

If the force structure assessment exceeds current programmed force structure levels, then identification of force structure tradeoffs within mission area or mission elements is required. Tradeoffs analysis are addressed to the degree necessary to bring the force structure assessment within current programming levels, if possible. The personnel support package will be tested during OT II."

Manpower Requirements Determination in MANPRINT

Currently, there are two major sources of MANPRINT regulatory information. The first is AR-602-2, MANPRINT. The second is the Draft chapter on MANPRINT that will be included in the revised TRADOC/AMC PAM 70-2, Materiel Acquisition Handbook (hereafter referred to as the revised TRADOC/AMC PAM 70-2).

According to AR 602-2 (p. 27), "MANPRINT data to support the BOIP/QQPRI shall be developed during the Proof-of-Principle Phase of the MAP. This regulation also cites HARDMAN and (ECA) as two techniques that can be used "as inputs to the BOIP process" (p. 27).

The revised AR 70-2 identifies the following activities related to Manpower Requirements Determination Aid (p. 11.44 to 11.76):

Requirements and Technology Base Activities Phase

- o Initiate HARDMAN and/or ECA early in this phase

Proof-of-Principle Phase

- o Conduct HARDMAN
- o Develop input to BOIP/QQPRI
- o Provide input to ROC on the "number of operators, maintainers, and repairers the new equipment requires in each unit." AR 70-2 describes the manpower requirements information to be included in the ROC.

The revised version of TRADOC/AMC PAM 70-2 provides additional information in manpower determination related to MANPRINT. According to this regulation, the DCD - Materiel and Logistics System Division, with input from DOTD, ARI, and AMC should provide input to Required Operational Capability (ROC). To provide this input this organization should conduct a force structure analysis using information developed in the organizational plan. The analysis would determine the number of pieces of new equipment going into each type unit and the number of operators, maintainers and repairers the new equipment requires in each unit. They should also identify proposed bill-payers to ensure a zero growth in the force structure, if the number required for the new system exceeds the number available from the displaced system.

Table 1 provides examples of the manpower and personnel information to be included in the ROC.

Table 1

Example of Manpower and Personnel Information to be Included in ROC.

<u>This is an example of Manpower/Force Structure Assessment to be included in the ROC, para 5a:</u>

"a. Manpower/Force Structure assessment. The manpower force structure indicates that when the system is fully fielded in accordance with current plans, it will generate the following requirements:

	Crew Per System	Crew System & Support Per Unit	Total Army Aggregate System Support (Other Units)	Total Army
OFF				
WO				
ENL				

Total Army personnel resource requirements are:

Active _____; savings/increase of _____.
USAR _______; savings/increase of _____.
NG _______; savings/increase of _____."

Example of MANPRINT manpower and personnel assessments to be included in the ROC, para 8b:

"b. Personnel Assessment.

(1) Crew level cannot exceed three soldiers. No maintenance task will require the use of more than one soldier. Maintenance tasks, when compared to the predecessor system, will be decreased by 20% at the unit level.

(2) The target audience description lists the expected aptitude levels (ASVAB scores) of the soldiers who have tentatively been identified as the operators and maintainers of the XM99.

2.4 USERS

2.4.1 Overview of Users and Their Functions

Primary Users. Primary MDA users will be the Directorate of Combat Development (DCD) organization within the TRADOC proponent schools responsible for developing the BOIP/QQPRI. Usually, this organization will be the Materiel and Logistic System Division. But since each DCD is structured somewhat differently, the responsible organization may vary.

Secondary Users. Another major MDA user will be the program manager's staff within the AMC subordinate command that provides input to the BOIP/QQPRI development process. Usually this staff is the Logistics Division or Group.

Other Users. Other potential users are the BOIP/QQPRI reviewers such as HQ TRADOC (DCSOPS); the Organizational Integrator, or Force Integration Staff Officer (FISO); and the Soldier Support Center-National Capitol Region (SSC-NCR). Other reviewers include HQ AMC (AMCDRE), the MANPRINT Policy Office within ODCSPER (DAPE-ZAM), and the MANPRINT points-of-contact within the TRADOC proponent schools and AMC subordinate command. The ARI field office representatives who may provide MANPRINT support to TRADOC schools or AMC subordinate commands are also potential users.

2.4.2 Job Type

The MDA will be developed specifically for the primary users listed in the section above. These primary users are the combat developers within the TRADOC proponent school who produce the BOIP/QQPRI. The individuals who actually perform these functions within the assigned DCD division are typically Army majors or captains.

2.5 Assumptions

The following assumptions underly development of the MDA:

Major System Focus. The MDA will describe manpower requirements for major weapon systems. Although the general logic of the MDA applies to other types of systems, we will develop the MDA's automated tools only for major systems.

Difference Between Force Structure Analysis and Manpower Determination. The MDA is an aid for determining manpower. It is not a force structure analysis tool. A manpower determination analysis determines the number of operators and maintainers needed to support a particular weapon system. A force structure analysis determines the size and composition of Army units. Force structure analysis considers tasks beyond those associated with individual weapon systems. It also assesses the impact of personnel and equipment attrition during wartime.

Attrition is beyond the scope of manpower determination as described an Army acquisition documents. As a result, tools such as AMORE that deal with attrition cannot provide a basis for manpower determination.

Operator/Maintainer Differences in Manpower Determination. The basic logic underlying determination of maintenance and operator manpower requirements is the same. It involves dividing workload demand by capacity. However, the specific elements used to calculate them are quite different. Maintenance manpower requirements are determined by computing total maintenance manhours for a given period (usually a fairly long period such as a year) and then dividing the results by a measure of capacity such as annual available maintenance manhours. Operator or maintainer workload is determined by examining cognitive/perceptual/physical workload at particular points in

time and then comparing this workload with the human capabilities for dealing with it. Our approach for determining manpower requirements reflects these differences. We will develop network simulation models to represent both operator and maintainer tasks.

We will evaluate operator manning based on a workload model that McCracken and Aldrich developed (1984)[1]. This process could also be used to determine workload for maintainer tasks if the analyst chooses to do so. The primary method of representing maintainer tasks, will be to use Micro SAINT networks. The networks resemble the ones that have been used to describe maintenance performance in a wide range of studies. Such studies include the Coordinated Human Resource Technology and the Air Force Logistic Composite Model that the Air Force used to determine maintenance manpower requirements.

Contractor Inputs to MDA. We assume that the prime contractor will provide information on the human interface design. This information includes a description of the operation and maintenance of all major system components, including support equipment (with particular emphasis on controls and displays). Basically, the contractor will provide the level of information required by the Type B1 specification of Prime Item Development Specification (see MIL-STD-490).

The MDA will not require information on system tasks, task performance times, or accuracies from the contractor. The MDA itself will provide procedures for generating these information elements.

Use of Army Manpower Algorithms and Allowances. The MDA

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[1]McCracken, J.H., & Aldrich, T.B. (1984). Analysis of selected LHX mission functions: Implications for operator workload and system automation goals (ARI Draft Technical Note).

will use, without modification, the basic manpower determination algorithm for variable positions in AR 570-2. It will also incorporate the work capacity factors listed in AR 570-2 and the Standards of Grade Authorization found in AR 611-201.

Personnel and Training Assumptions. This specification focuses on the MDA's initial application. In this first application, workload estimates are based on an assumption that (1) personnel with the median level of personnel characteristics (as determined by the Personnel Requirements Estimation Aid) are performing the tasks, and (2) the type and amount of training these personnel have received is that which is most likely to be assigned (as determined by the Training Constraints Estimation Aid).

The MDA will be iterated in subsequent tradeoff analyses as part of the application of the MPT Tradeoff Analysis Aid. These tradeoffs will explore different assumptions about personnel and training.

Job Determination. The MDA will help identify jobs. The analysis will define operator jobs by assigning specific tasks to duty positions. This concept is congruent with the Army's Job Books which break out operator tasks by duty position. After the assignments have been made, the MDA's automated steps will assess how these assignments affect workload and system capability.

Maintenance jobs are defined by assigning specific tasks to MOS/skill level combinations at particular maintenance levels. The Army does not have duty positions for maintainers. The MDA will include procedures for assigning maintenance tasks to MOS/skill level combinations.

2.6 HIGH LEVEL FUNCTIONAL REQUIREMENTS

2.6.1 Technical Requirements

<u>Outputs</u>. The MDA will output quantitative manpower requirements, by job, for a specific contractor design. These manpower requirements will include: (1) operator manpower requirements, (2) maintenance manpower requirements, and (3) Direct Productive Annual Maintenance Manhours (DPAMMH).

For maintenance the MDA will also be capable of breaking out manpower requirements by MOS, skill level, major component item (maintainers only), and maintenance level (maintainers only) and will be capable of breaking out all estimates at both the single system and aggregate level.

In addition to producing estimates of manpower requirements, the MDA will produce estimates of system availability, reliability, and operational effectiveness. These estimates will be compared with the requirements for these criteria identified by the System Performance Requirements Estimation Aid (SPREA) identified during the Requirements Technology/Base Activities phase of the MAP. Based on this comparison, shortfalls (discrepancies between requirements and estimates based on contractor designs) will be identified.

<u>Role in Acquisition Process.</u> The MDA information on manpower requirements will be designed to feed directly into the BOIP/QQPCI.

<u>Users</u>. The MDA will be specifically designed for use by the combat developers within the TRADOC proponent school who produce the BOIP/QQPRI (see Section 2.4.1).

2.6.2 Acceptability/Usability Requirements

The previous sub-section presented an overview of the technical requirements that must be met by the MDA. This section describes some of the acceptability and usability requirements which also must be met by these tools.

Produce Tailored User Outputs and Processes. Previous R&D products have not been implemented because they failed to meet the needs of individual Army decision makers. They were R&D products "in search of users". To avoid this problem in the current effort, it is critical that specific users be identified for the MDA. Furthermore, the outputs of the MDA will be formatted so that Army users can insert them directly in MAP documents. Additionally the aids will be capable of producing results in a timely fashion and be capable of meeting the requirements of the new streamlined acquisition process. The latter requirements indicate a need for using some form of automation to support each product whenever it is cost effective to do so.

Describe "How To" Procedures. Sufficient "how to" procedures will be included in the MDA to allow Army users with minimal training to apply each product. Whenever possible, procedures will be automated to reduce user analysis requirements. However, for all automated tools, detailed procedures for obtaining input data and interpreting results will be presented. For all manual tools, detailed instructions for conducting each analytical step will also be provided.

Minimize Organizational Impacts. The MDA will be designed to fit the user and not vice versa. Consequently, they will not require additional personnel to apply or cause restructuring of existing Army organizations; they will utilize computer hardware available at user locations or accessible via secure lines.

Minimize User Training. The members of the MAP community who are expected to be users of the MDA are already overburdened and understaffed. In addition, they are trying to meet increasing acquisition requirements such as MANPRINT within the context of the streamlined acquisition process. Consequently, training time for the $(MPT)^2$ products will be minimized. This requires development of user interfaces that require no prior computer experience. For example, the interface contain built-in job aids (e.g., help commands). Finally, when formal training is required, it will be developed in accordance with Army instructional system design principles and utilize only media that are readily available or accessible to users.

Security. The MDA may be required to accept classified data and will be designed to provide acceptable levels of security.

2.7 HARDWARE/SOFTWARE CONFIGURATION

The hardware system that the MDA will be installed on consists of the following components:

1. Enhanced graphics display. The EGA will support high resolution color graphics.
2. Enhanced graphics board with 256K bytes RAM.
3. 80286 processor
4. Hard disk with a minimum of 20M bytes of storage.
5. Up to 4M bytes of enhanced memory.
6. Bernoulli Box or its functional equivalent with two removable 20M disks.
7. 80287 Math Coprocessor.
8. 1200/2400 baud Hayes-compatible internal modem.
9. One or more floppy drives that can read and write 360K floppy diskettes.
10. Dot matrix printer capable of printing 132 characters

per line. This printer will be capable of outputting IBM graphics.

11. IBM AT-compatible keyboard.

The MDA software will be developed under the most recent version of Microsoft C. At the present time, the operating system for the software will be DOS 3.2.

The data libraries in the MDA will be built using R-Base V. We will sort, retrieve, and store information in these files using code developed in-house via dbC Library routines. These library functions do not require any licensing fees and will be fully integrated into the MDA code.

SECTION 3 - STEPS IN APPLYING THE MDA

As was proposed in the concept paper and outlined in section 2 of this design specification, the MDA consists of two distinctly different software tools that the analyst will use to estimate the manpower requirements for a proposed new system. The Maintenance Manpower Analysis Aid (MMAA) will allow the user to analyze the manpower required to maintain a proposed new system in terms of the maintenance jobs required (MOS/Skill levels), the number and types of maintenance tasks that must be performed by each maintenance job, the maintenance manhours required for each job, and an estimate of the headcount required for each maintenance job.

The Workload Assessment Aid (WAA) will guide the user through the process of assessing the manpower requirements of a proposed new system by estimating the workload requirements of a proposed staffing plan for operating the system or for performing maintenance activities.

This section will describe the global keystroke specifications and the user actions that are that are generic to all of the activities that users will perform in using the MDA. These generic specifications are followed by the detailed specifications that are specific for each of the steps within the MMAA and the WAA.

Since the steps associated with each of the analysis aids are so distinctly different, we have used a different numbering scheme for the two sets of steps. The steps in the MMAA are numbered 1.1 through 1.8. Steps in the WAA are numbered 2.1 through 2.11.

The first step in using either the MMAA or the WAA is to identify the system that is to be evaluated. Therefore, the process for performing step 0 will be described before the description of the MMAA or WAA steps.

The description of each step is organized into the following parts:

1. Input - the data that is required for the completion of the step. There are two types of input data.
   - o External - inputs obtained from sources external to the MDA
   - o Internal - data that is obtained from sources that are included within the MDA.

2. Process - a general description of the process that the user will follow to perform the step. Included in the process description is a detailed flow diagram of the actions the user will follow.

3. Output - the data that will be generated as a result of the step.

4. User Interface - a description of the way the user will be prompted and the way the user will respond throughout the performance of the step. This is a very detailed discussion of each screen the user will see as a result of his or her input.

3.1 GLOBAL KEYSTROKE SPECIFICATIONS

Following is a list of the general specifications for the functionality of global function and editing keys for the Product 5 Manpower Determination Aid.

FUNCTION KEYS

F1 Help - This key will always switch the system into the help mode. When this key is pressed, the system will display the first page of context specific help information explaining the current menu, screen, or prompt.

Shift F1 Help Index - When the F1 function key is pressed while holding down the shift key, the user is presented with an index of help information.

F2 Move-by-cell/Edit toggle - This key controls the function of the arrow cursor keys when the user is working in a spreadsheet-like template. In the default state, the arrow keys will move the cursor from cell to cell in the template. When the F2 key is pressed, or when the user begins to type, the system switches into the "Edit" mode and the arrow keys move the cursor character by character (left and right) or line by line (up and down) within a cell. If the cursor is in the first character position of a cell and the left arrow is pressed, or if the cursor is in the topmost line of a particular cell and the up arrow is pressed, the system will beep. The user can terminate an edit operation and return to the "Move-by-cell" state. Repeated pressing of the F2 key will toggle between the move-by-cell and move-by-character states.

F3 <u>Search</u> - When this key is pressed, the user will be prompted for a string of characters or keystrokes that the system will search for. The string of keystrokes is terminated by pressing the F3 key a second time. After terminating the string, the system will search the current library, template, or list for a match for the input string. If a match is found, the cursor is moved to the matched input string. If no match is found, the cursor remains where it is and a message indicating no match found is displayed.

At times when the F3 key is not active, the user will receive a message indicating such.

F4 NOT USED AT THIS TIME

F5 NOT USED AT THIS TIME

F6 NOT USED AT THIS TIME

F7 NOT USED AT THIS TIME

F8 NOT USED AT THIS TIME

F9 <u>Menu</u> - Displays the active menu bar while working in a spreadsheet-like template. This key uses a "toggle" type of functionality. When the commands on a menu bar are displayed, the cursor moves from command to command within the menu bar. When the menu bar commands are not displayed, the cursor moves around within the current template.

F10 <u>Save</u> - Saves the current working file to the appropriate permanent file then returns to the current working status. NOTE: The "save" command may also

appear on a menu bar when it is appropriate save at the end of an activity or procedure. However, in order to make it easy for a user to save early and often, this key is also always active.

EDIT KEYS

ESC — quit - Always returns to the most recent previous state such as the most recent menu, screen, or prompt.

Shift ESC — super quit - Always returns to the MDA main menu. If changes have been made to the current working file, the user will be prompted to save or cancel changes.

Backspace — This key is only active when the system is allowing for input by the user. The backspace key moves the cursor one space to the left of its current position and erases any character from that position.

Return — Terminates variable length user input. If the user is currently working in a spreadsheet-like template, entering the return key changes the state of cursor movement from move-by-character to move-by-cell.

Caps Lock — Toggles the keyboard from a normal state to one that displays characters as if the shift key was being held down. When the keyboard is in the "Caps Lock" state and the user holds down the shift key while pressing another key, the normal (non-shift) character displays.

Ins — Insert - Toggles the system from character insert for user input to typeover. When the state is character insert, the characters input by the user are inserted to the left of the current cursor position. When the

state is typeover, characters are displayed at the current text cursor position. Any characters currently displayed at that position will be replaced.

Del	Delete - Deletes characters that are displayed at the current text cursor position.
Home	Moves the menu cursor to the top or the left most menu selection. Moves the cell cursor to the upper left corner of a spreadsheet-like template. Moves the text cursor to the upper left most typing position of the current input area (i.e., cell, field, etc.). See cursor definitions below.
End	The end key works the exact opposite of the home key. It moves the menu cursor to the bottom or the right most menu selection. It moves the cell cursor to the lower left corner of a spreadsheet-like template. It moves the text cursor to the lower right most typing position of the current input area. See cursor definitions below.
PgUp	Page Up - If the cursor (menu, text, of cell) position is not at the top of the current visible display or window, the cursor is moved to that position. If the cursor position is at the top of the current visible display or window, the cursor is moved to the top of the previous full screen or window-full of information.
PgDn	Page Down - If the cursor (menu, text, or cell) position is not at the bottom of the current visible display or window, the cursor is moved to that position. If the cursor position is at the bottom of the current visible window, the cursor is moved to the

bottom of the next full screen or window-full of information.

Up Arrow - Moves the cursor (menu, text, or cell) up one position (line or cell).

Down Arrow - Moves the cursor (menu, text, or cell) down one position (line or cell).

Left Arrow - Moves the cursor left one position (character or cell).

Right Arrow - Moves the cursor right one position (character or cell).

Ctrl Up Arrow - Moves the cursor (menu, text, or cell) up one full screen or window-full of information to its same relative horizontal position.

Ctrl Down Arrow - Moves the cursor down one full screen or window-full of information to its same relative horizontal position.

Ctrl Left Arrow - Moves the cursor to the left by one screen or window-full of information to its same relative vertical position.

Ctrl Right Arrow - Moves the cursor to the right by one full screen or window-full of information to its same relative vertical position.

CURSOR TYPES

Text Cursor	Indicates the typing position for user input of information. The text cursor is a flashing underscore character.
Menu Cursor	Highlights a menu option. The menu cursor can be moved in appropriate direction with the arrow keys on the numeric key pad.
Cell Cursor	Highlights an entire cell in a spreadsheet-like template to indicate which cell any subsequent activity will take place. The arrow keys move the cell cursor from cell to cell in the direction of the arrow.

3.2 MENU TYPES AND SELECTION STRATEGIES

Menu Bars

Display at the top of the screen. The exception to this is the menu bar that displays at the bottom of help screens. Menu bars contain a horizontally displayed list of command verbs. To select a command verb from a menu bar, you either press the fist letter of the command you want to issue or move the menu cursor with the left and right arrow keys to the desired command and then press the RETURN key. The cursor on a menu bar will wrap from the last command to the first and vice versa.

When a command is highlighted on a menu bar, a brief description of that option is displayed on the line directly below the horizontal list of menu options.

Pop-Up Menus

There are two levels of pop-up menus. The first level is a direct result of selecting a command from a menu bar or from a main flowchart menu that displays at the beginning of the MDA, the MMAA, or the WAA (see description below). The second level of pop-up menus display overlapped on the first level and are a direct result of a selection from the first level menu.

Menu items on a pop-up menus consist of either activity areas you select to work in or items from a taxonomy, library, or other list that you can select.

There will be a maximum of ten possible selections displayed on a pop-up menu. Each selection position will be numbered 0-9. If there are more items in the list than will fit into one of the selection positions, the user will be able to scroll or page through the list with arrow keys.

There are two ways that you can select an item from a pop-up menu. You can press the key corresponding to the position number displayed next to the option you desire. You can move the menu cursor to the option you want to select with the up and down arrow keys and/or the PgUp and PgDn keys and then press the RETURN key.

Some pop-up menus may be displayed with command verbs shown at the bottom of the pop-up window. Commands appear on the pop-up menu (rather than on the menu bar) when the actions that they invoke apply only to the current pop-up menu. For example, in may be necessary to insert a new item

into a list that displays in a second level pop-up menu. In this case, if the "insert" command appeared at the bottom of the second level pop-up menu.

The procedure for selecting a command from a pop-up menu is the same as for selecting a command from a menu bar.

Pressing the ESC key always returns control to the previous menu or prompt.

3.3 GENERIC COMMAND DESCRIPTIONS

Following is a list of descriptions of commands whose general functionality is consistent throughout the MDA. Commands that are specific to an individual step are described in the discussion of the screens that apply to that step.

select — The select command is used in two slightly different contexts. However, its use is consistent throughout the MDA. When the select command is displayed at the bottom of a first level pop-up menu with the type-in as the other command option, it means "I want to select an entry for the highlighted field from a list of options". When the select command is displayed at the bottom of a list of options select means to choose the highlighted option. When the pop-up menu consists of a list of options and there are no commands displayed, the user can issue an implicit "select" command by highlighting the desired option and pressing the <ENTER> key or by pressing the number of the desired option.

insert — This command lets the user "insert" a new item into a list of options such as a new functional system or a new Mission/Condition Set file name. To perform the "insert" operation, the user highlights the option <u>before</u> the position where the insert is to occur. Then, when the insert command is issued by highlighting it and pressing <ENTER> or by pressing the "i" key, a new position opens up in the list with a flashing cursor prompting the user to enter a new name. After the new name has been entered, the system will behave as if a "modify" command had been issued (see below).

modify — When this command is available, it lets the user modify parameters that are associated with a given option. For example, in many cases a menu will contain a list of template names such as the list of function templates. When the user chooses the modify command he or she will be able to enter or modify information contained in the highlighted template name.

copy — This command lets the user "copy" an item in a list of options such as a functional system or a Mission/Condition Set file name. When an item is copied, all of the parameters or information associated with that item will also be copied. To perform the "copy" operation, the user highlights the option to be copied. Then, when the copy command is issued by highlighting it and pressing <ENTER> or by pressing the "c" key, a new position opens up in the list with a flashing cursor prompting the user to enter a new name.

delete — In the general sense, this command lets the user delete an item and all of its associated parameters and information from a list of options. When the delete command is issued, the user will be presented with a

message notifying that data will be lost if the delete is executed. When this message is displayed, the user will be required to verify or cancel the delete operation. Any specific functionality for the delete command that differs from this definition will be described in the discussion of the screens that apply to that procedure.

3.4 STEP 0 - Enter the MDA and Identify the System to be Evaluated.

In this step, the user will gain access to the Manpower Determination Aid. From the first level of MDA interfaces, users will indicate whether they want to begin an analysis of a new system or resume work on an analysis already in-progress. Whether beginning a new analysis or resuming work on an existing analysis, the analysis must begin by identifying the system.

3.4.0.1 Input

External: The external input to this step is a set of System Files and Mission/Condition Set Files obtained from a Product 1 SPREA Analysis (if available).

Internal: The internal inputs for this step are the taxonomies for Mission Areas, System Types, Generic Functional Systems, and Mission/Conditions.

3.4.0.2 Process

The user will begin by accessing the MDA software from his or her computer system. This will be accomplished by simply

booting up the operating system and, at the operating system prompt, entering: MDA

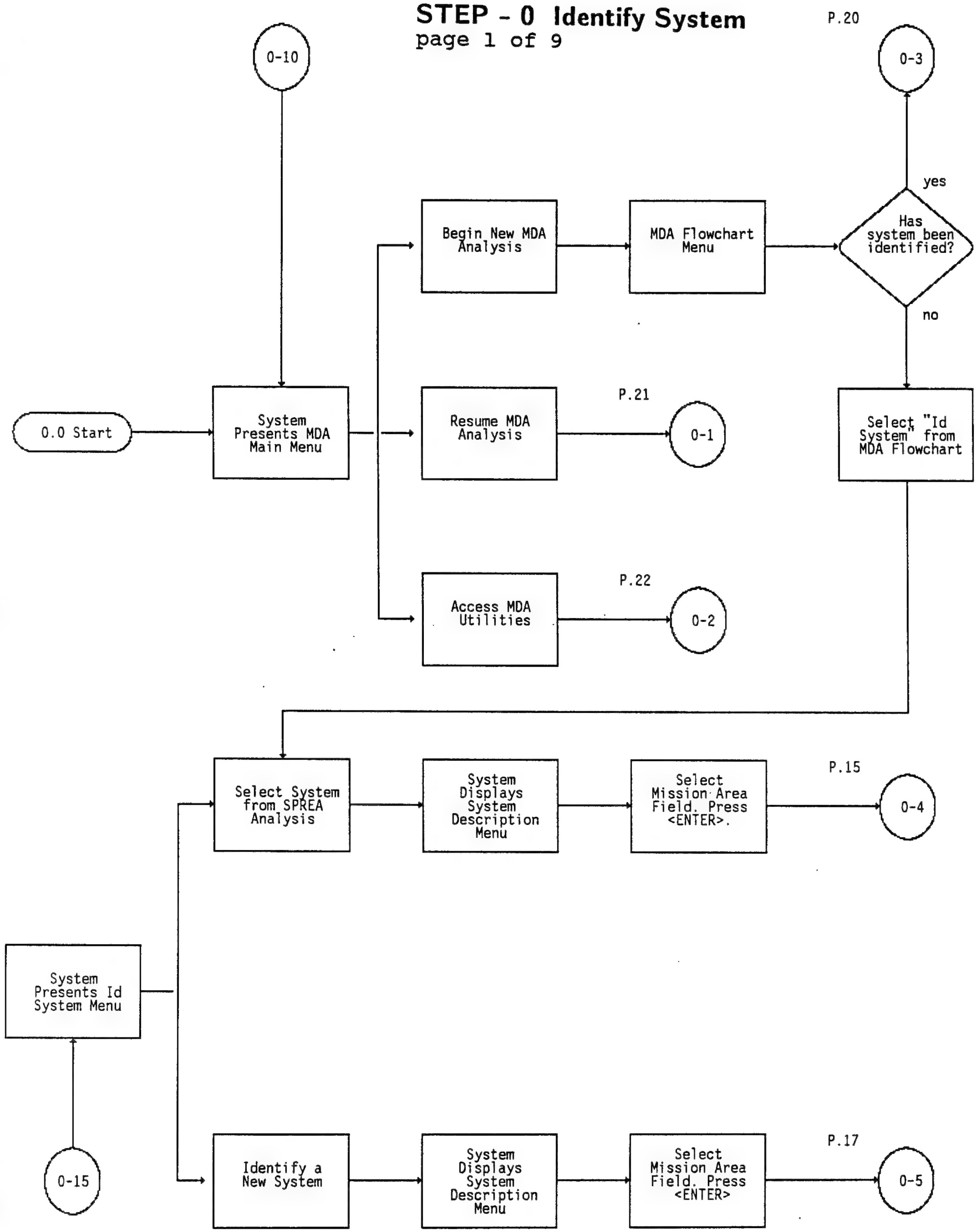
Once the user has gained access to the MDA software, he or she will specify whether to begin an analysis for a new system, resume an in-progress analysis or gain access to the MDA Utilities.

If the user chooses to begin a new analysis, the MDA software will guide him or her through a complete identification of the system to be analyzed. This will include identifying the Mission Area, System Type, System Name, and Mission/Conditions for the MDA analysis. When the user is beginning a new analysis, he or she will also be able to choose whether to select the system from a Product 1 SPREA analysis or to identify a new system from scratch.

If the user is resuming work on an existing system under evaluation, he or she will only need to specify the system name and the Mission/Condition set file name to identify the system.

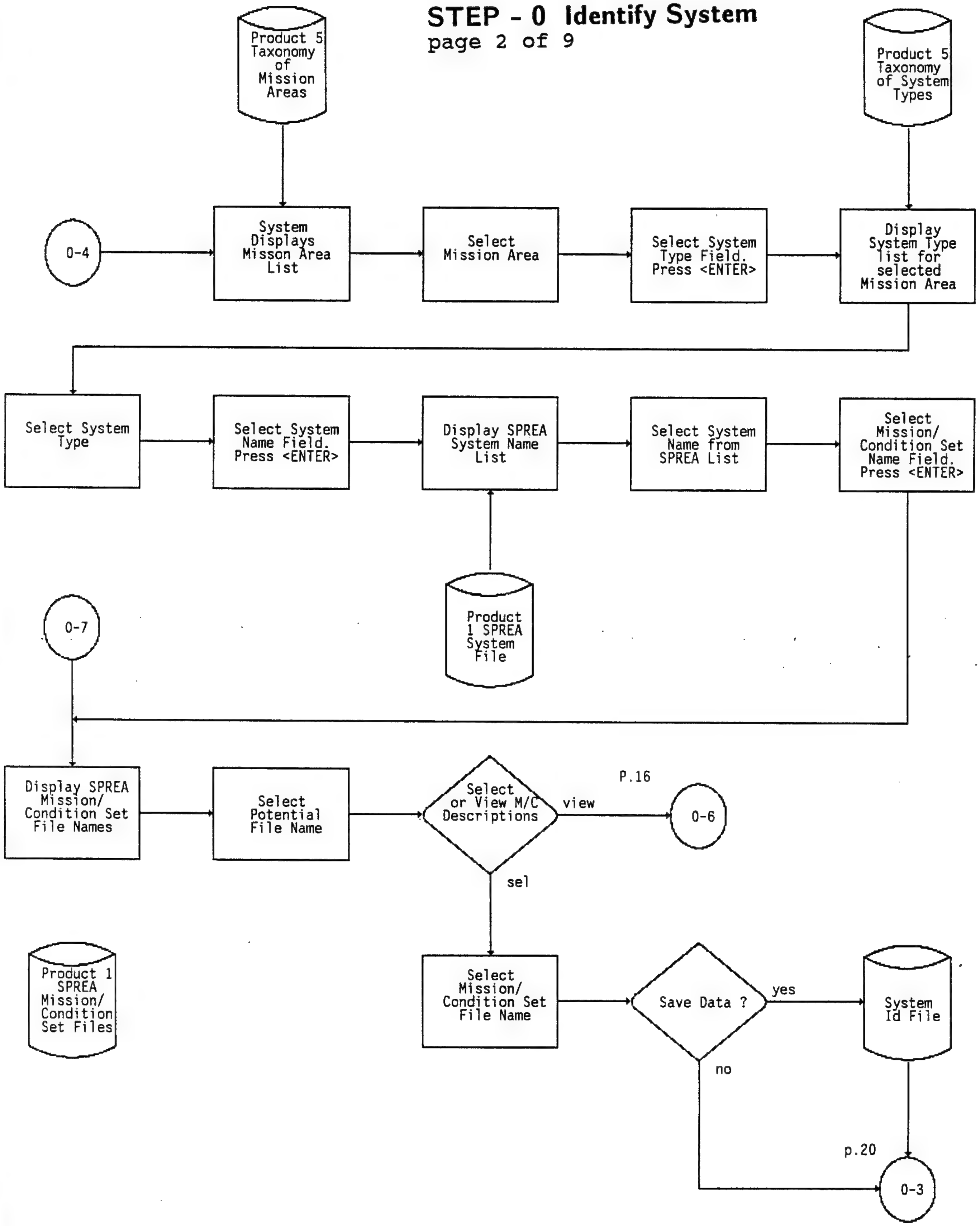
The flow diagrams of the process of performing step 0 are included on the following pages.

STEP - 0 Identify System

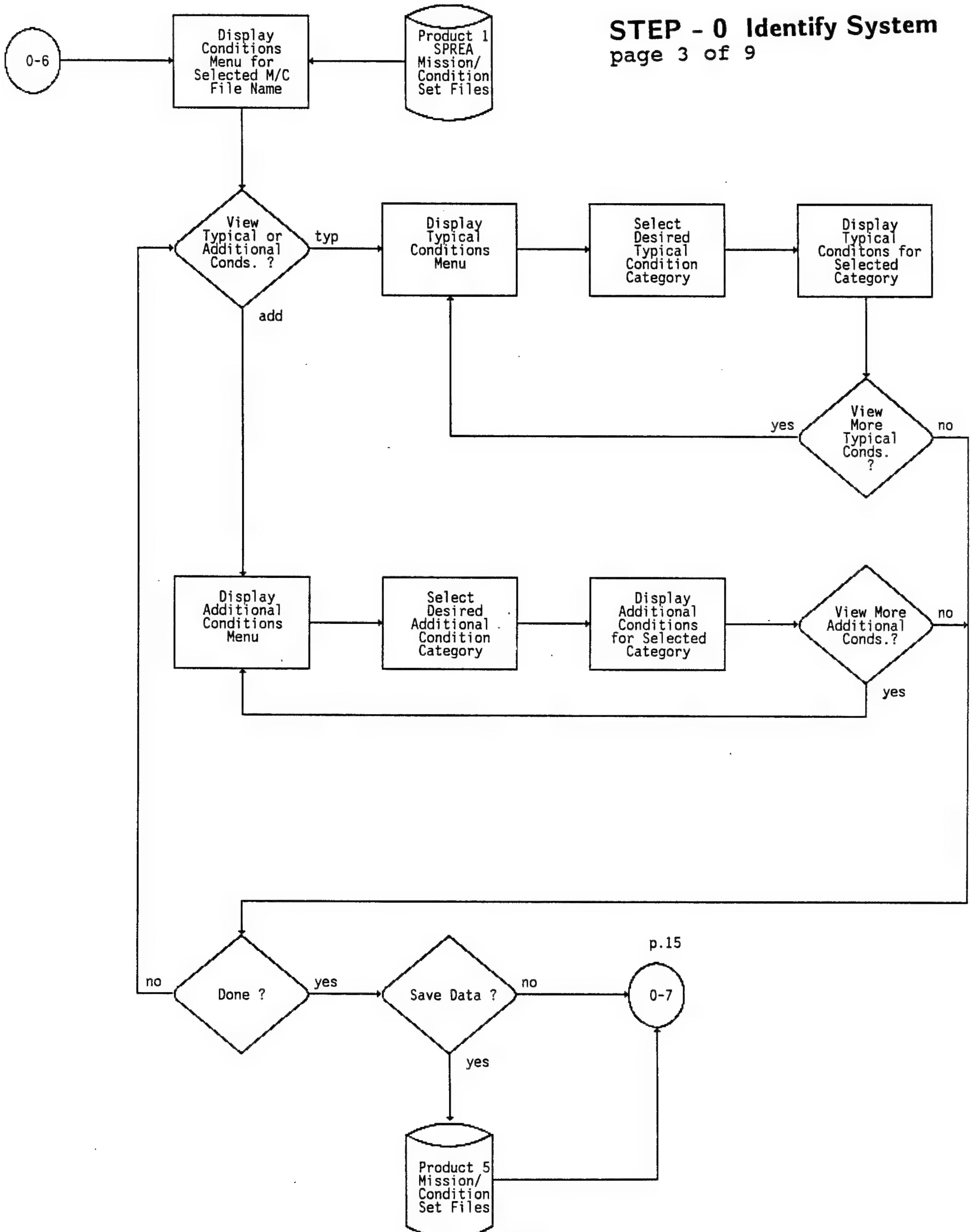


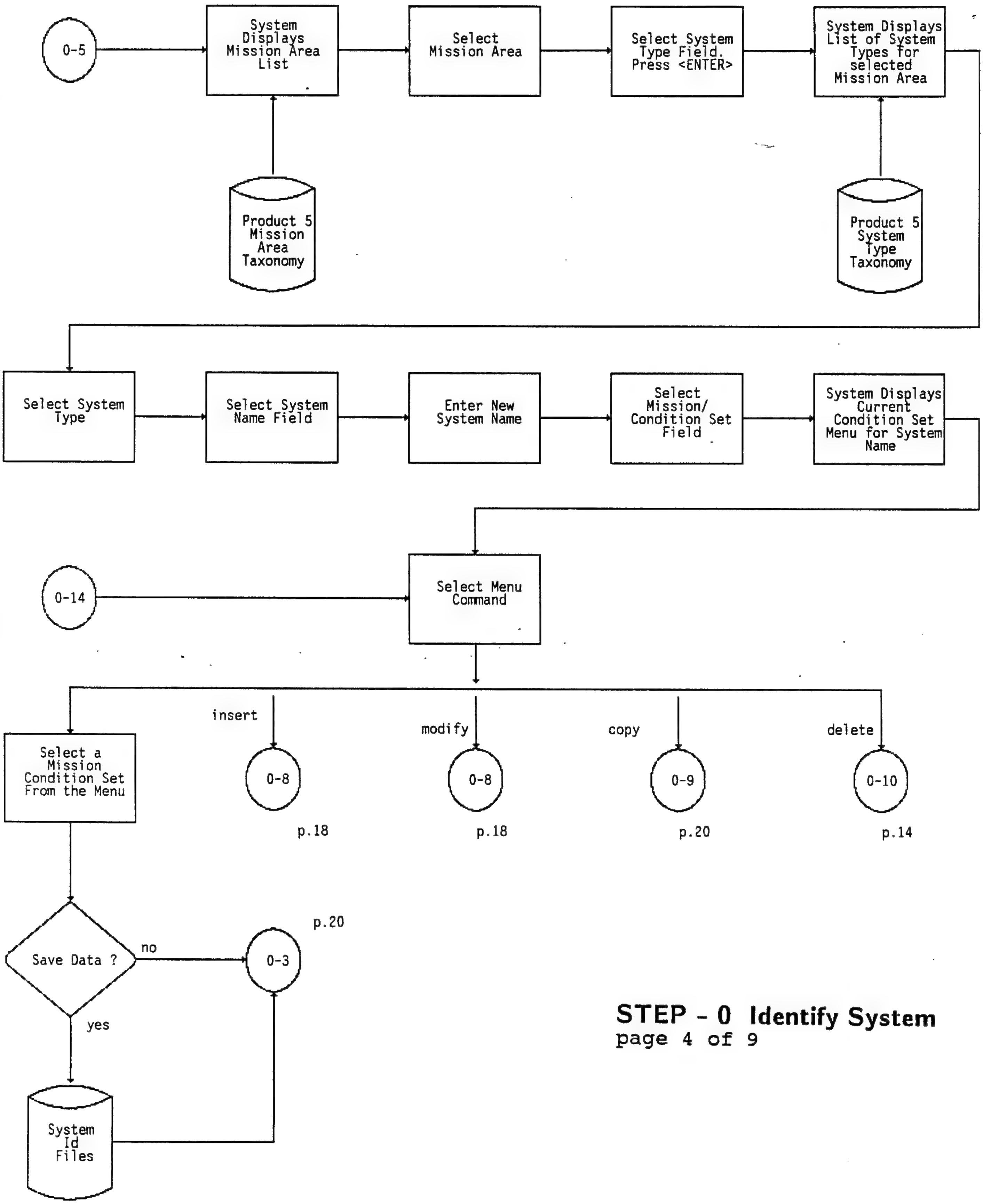
STEP - 0 Identify System

page 2 of 9

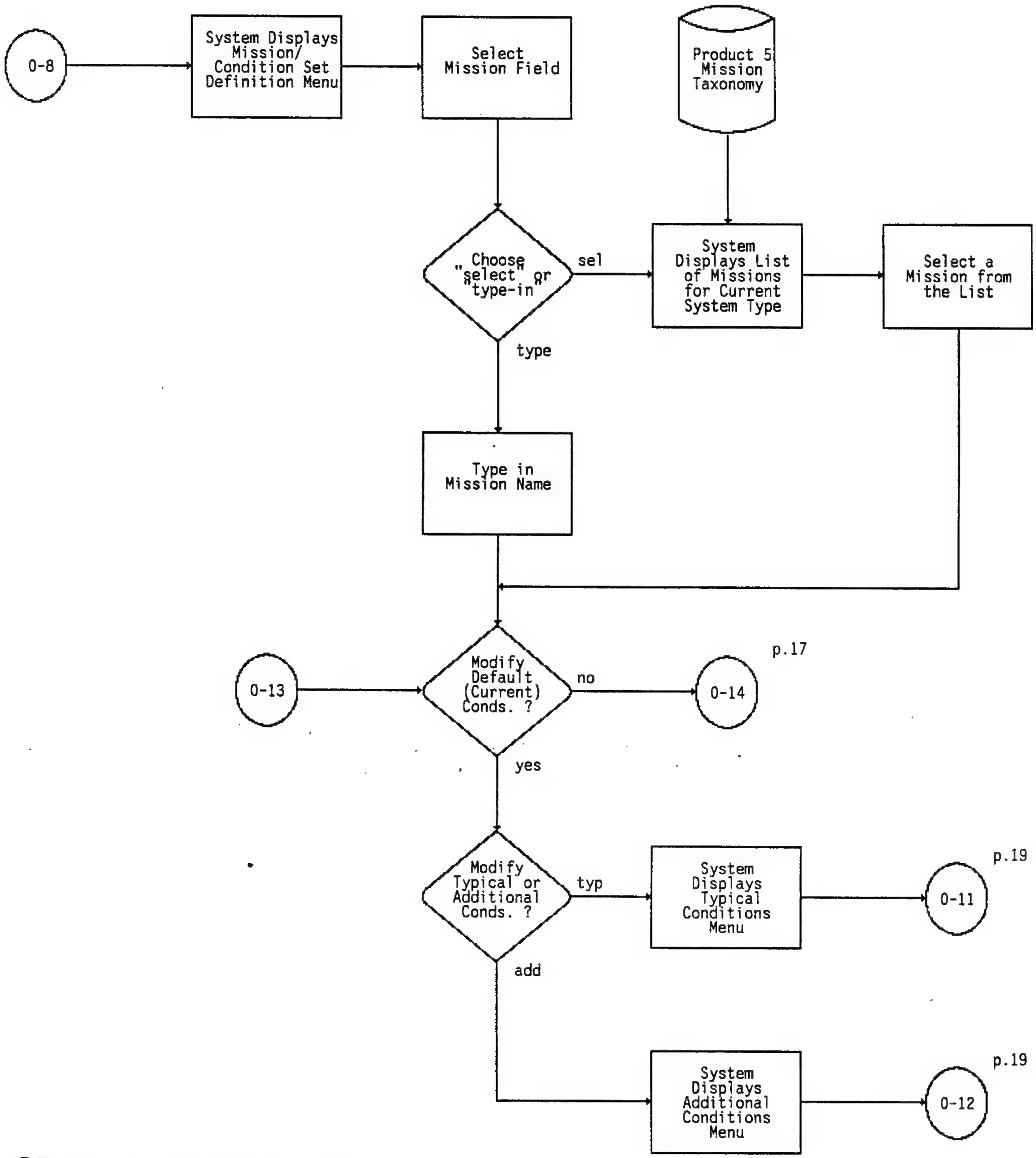


STEP - 0 Identify System



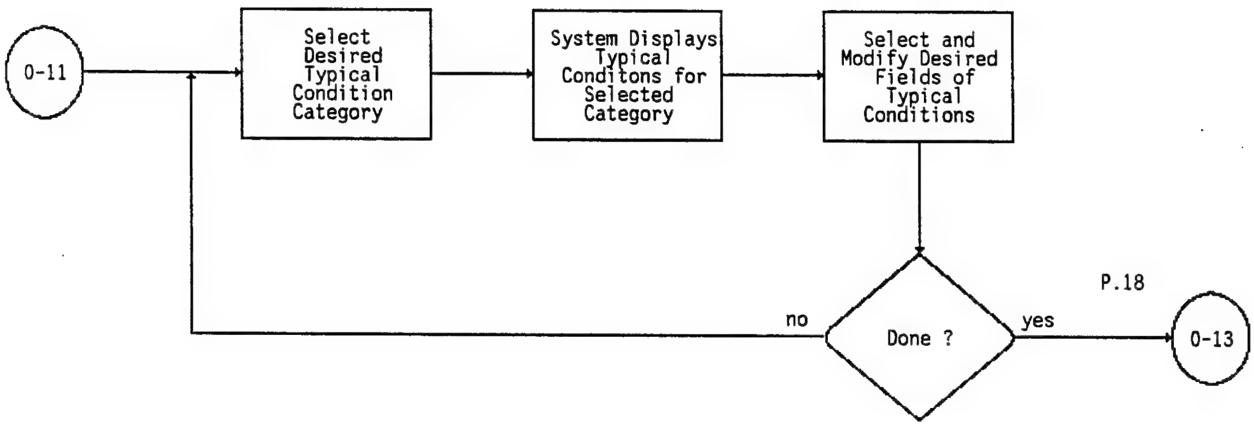


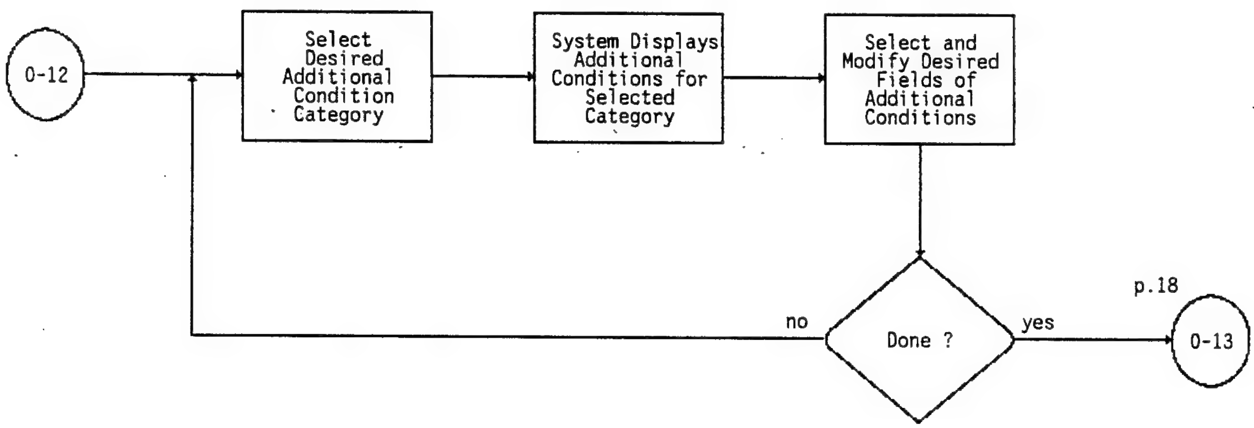
STEP - 0 Identify System
page 4 of 9

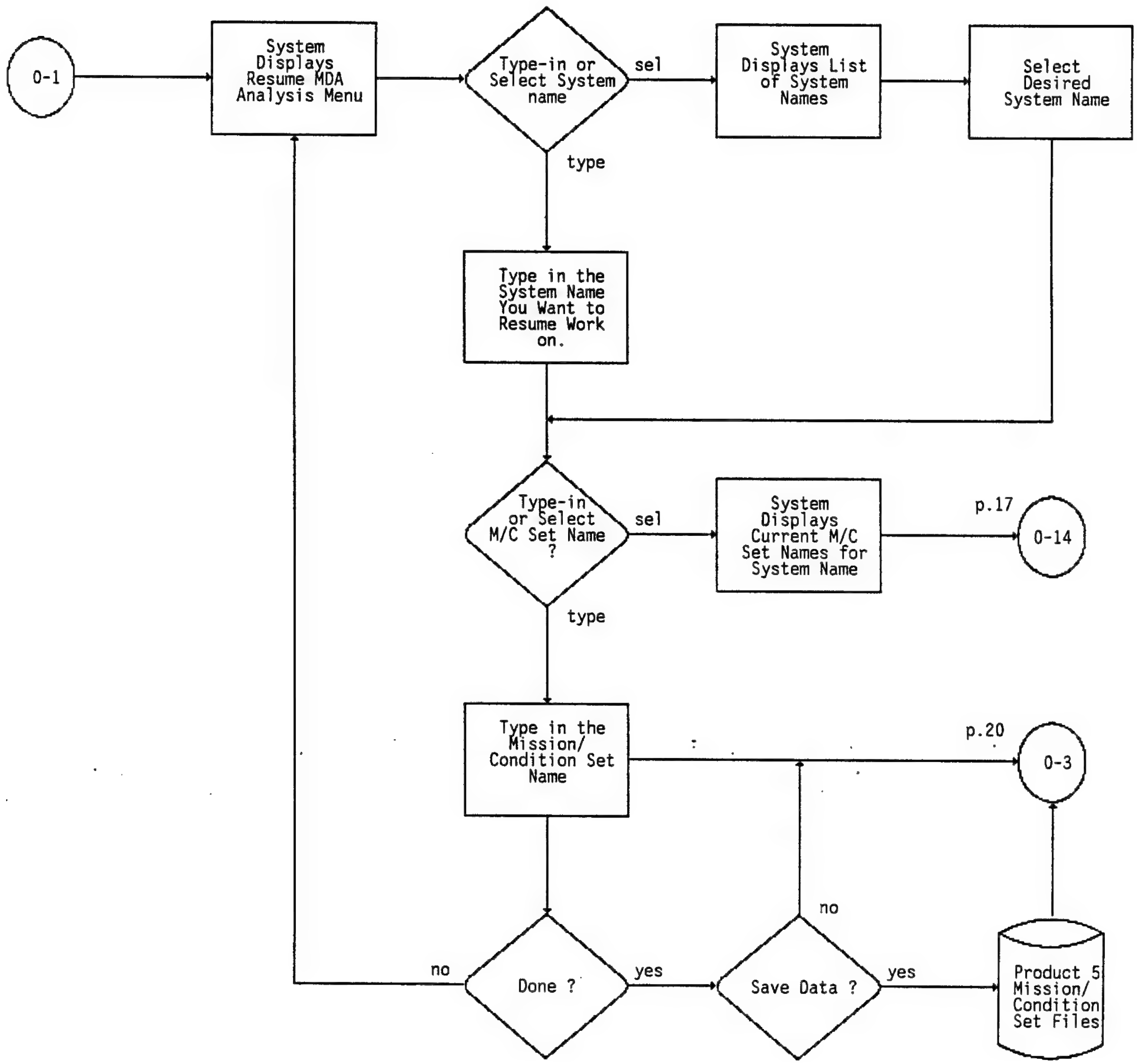


STEP - 0 Identify System
page 5 of 9

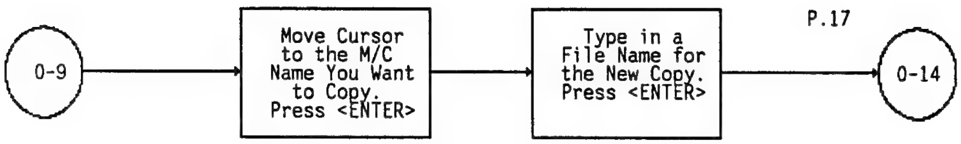
STEP - 0 Identify System
page 6 of 9



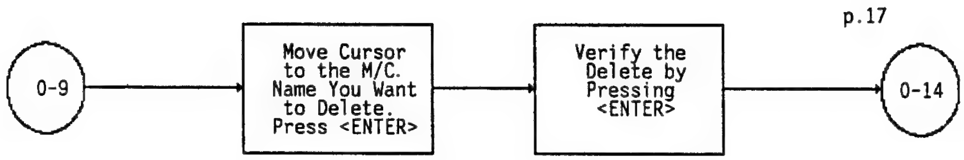


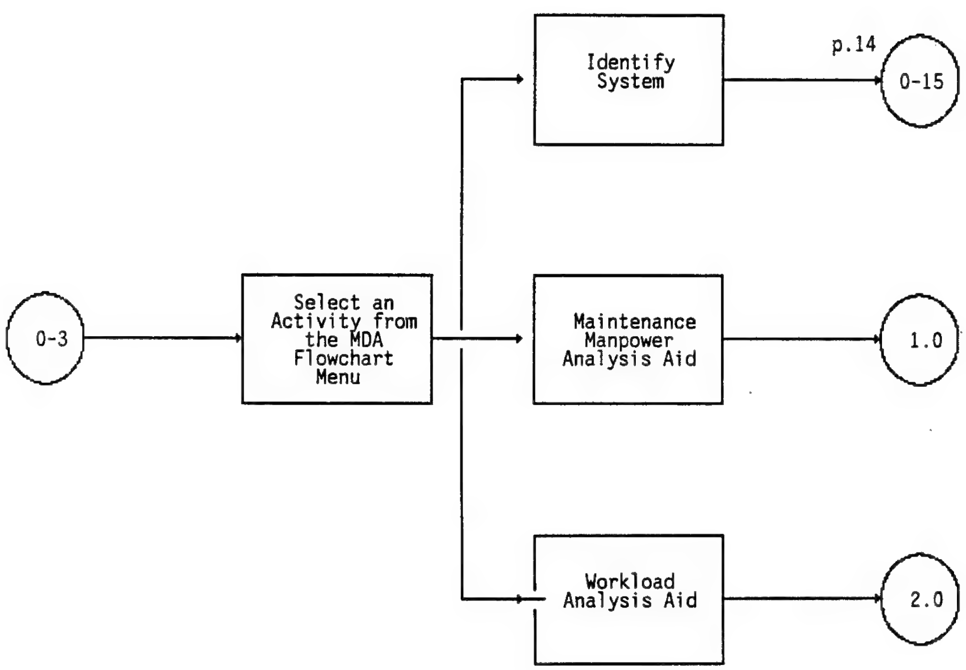


STEP - 0 Identify System
page 7 of 9

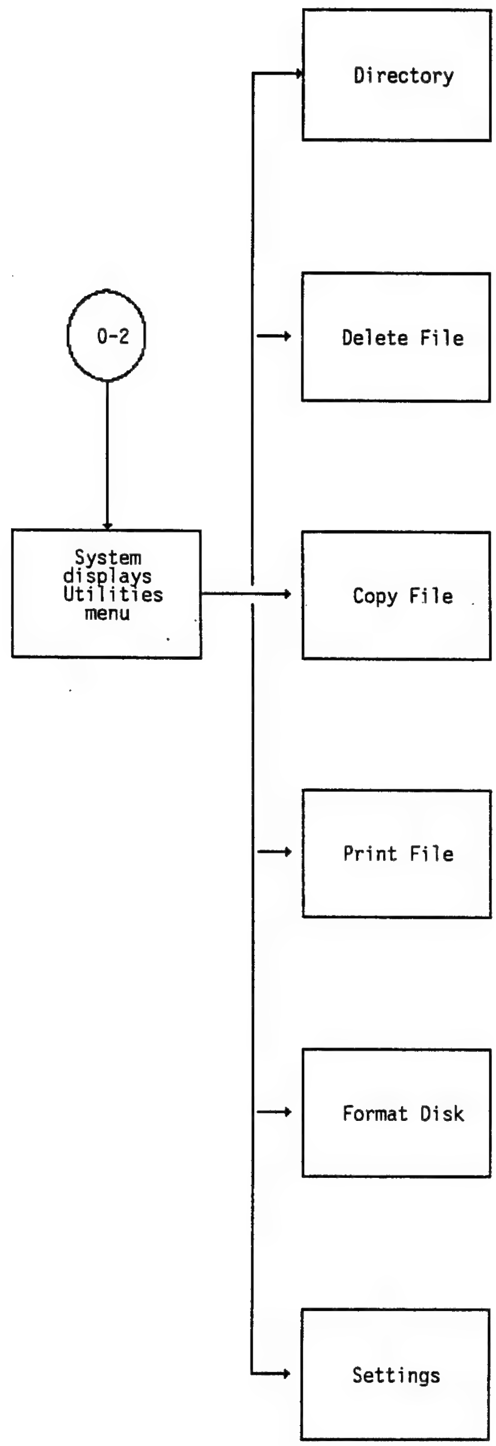


STEP - 0 Identify System





STEP - 0 Utilities
page 9 of 9



3.4.0.3 Output

The output of this step is the creation of a file that identifies the system for future I/O activities and the creation of a Mission/Condition set file that describes the mission for the current analysis and conditions under which that mission will be analyzed.

3.4.0.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for step 0 are labeled "Screen 0.X".

Screen 0.1 - Access the Manpower Determination Aid by typing "MDA" at the operating system prompt (C>_).

This is the Manpower Determination Aid Title Screen.

User Action:

<SPACE BAR> This is the only accepted input with the exception of F1 (help). The system displays screen 0.2.

MANPOWER DETERMINATION AID

Press the SPACE BAR to begin

Screen 0.1 - **Access the Manpower Determination Aid by typing "MDA" at the operating system prompt (C>_).**

Screen 0.2 - Manpower Determination Aid Main Menu.

<u>User Action:</u>
The user can take generic menu selection procedures to select one of the items on the menu. If the user presses the <ESC> key, screen 0.1 will display.

1. Begin Analysis - When the user selects this option, screen 0.3 displays.

2. Resume Analysis - When the user selects this option, screen 0.3 displays.

3. Utilities - When the user selects this option, screen 0.59 displays.

<ESC> - Displays screen 0.1.

```
MANPOWER  DETERMINATION  AID
         MAIN  MENU

      1.   Begin Analysis
      2.   Resume Analysis
      3.   Utilities
```

Screen 0.2 - Manpower Determination Aid Main Menu.

Screen 0-3 - Flowchart Menu for the MDA

This screen is a menu of the activities that the user can select from within the MDA. The way that the menu is displayed also serves as a flowchart of the sequence in which the activities should be performed. The flowchart shows that the "Identify System" option must be performed before selecting either the MMAA or the WAA. Once the system has been identified, the user can select either the MMAA or the WAA as the next option. The user can select an item from the flowchart menu by using one of the normal (generic) menu selection procedures:

1. Highlight the desired option using the up, down, left, right arrow keys and then press <ENTER>.

2. Enter the number of the desired option.

User Actions:

1. Identify System - If the user previously chose to begin a new analysis, the next screen is 0.5. If the user chose to resume an analysis already in-progress, the next screen is 0.50.

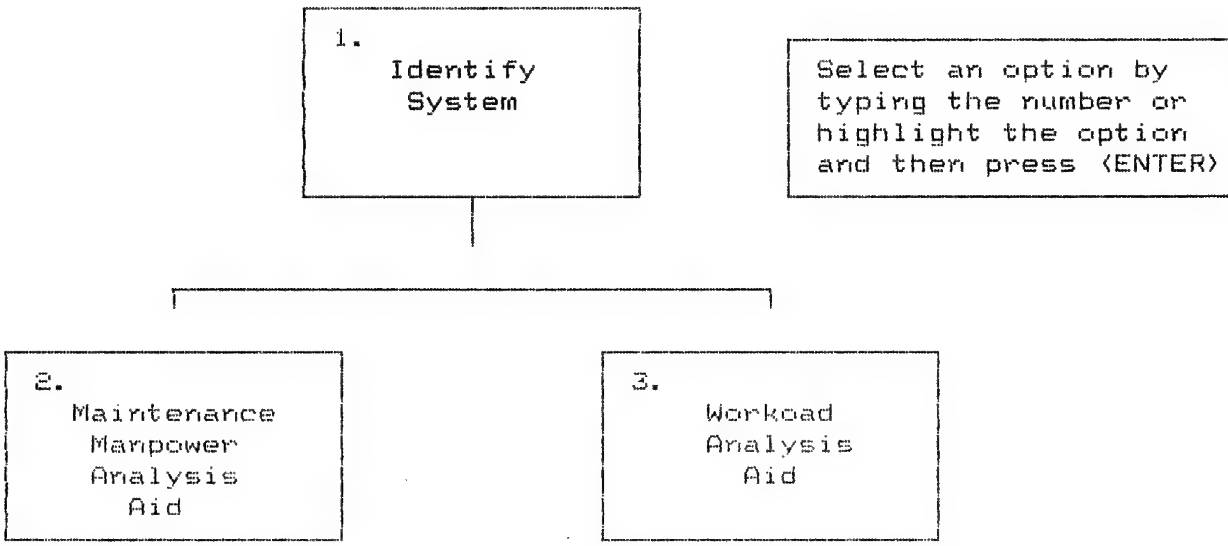
2. Maintenance Manpower Analysis Aid - if this option is selected and the system has not been identified, the next screen is 0.4. If the system has been identified, the next screen is 1.0.

3. Workload Analysis Aid - if this option is selected and the system has not been identified, the next screen is 0.4. If the system has been identified, the next screen is 2.0.

<ESC> - Returns the user to screen 0.2.

MODE: MDA> MODE: Work

FLOWCHART FOR THE MANPOWER DETERMINATION AID



Screen 0-3 - Flowchart Menu for the MDA

Screen 0.4 - Error Message.

The user has chosen to access the MMAA or the WAA without first identifying the system.

User Action:

The only acceptable user action from this screen is to press the <ENTER> key. Next screen is 0.3.

MODE: MDA>   MODE: Work

FLOWCHART FOR THE MANPOWER DETERMINATION AID

1.

ct an option by
ng the number or
light the option
then press <ENTER>

You must identify the system before
you can analyze maintenance or
workload requirements.

Press <ENTER> to continue.

2.
Maintenance
Manpower
Analysis
Aid

3.
Workoad
Analysis
Aid

Screen 0.4 **Error Message**

Screen 0.5 - Identify System Menu.

Lets the user choose to identify a system for which a Product 1 SPREA analysis was performed or identify an entirely new system from scratch.

User Action:

1. Select system from SPREA analysis. Next screen is 0.6.

2. Identify new system. Next screen is 0.6

<ESC> - Returns the user to screen 0.3.

PATH: MDA>Id System>　　　　MODE: Work

IDENTIFY SYSTEM
1. Select system from SPREA analysis 2. Identify new system

Screen 0.5 - Identify System Menu.

Screen 0.6 - System Description Menu.

From this menu, the user will identify the Mission Area, System Type, System Name, and Mission/Condition Set for the system under evaluation. If the user is selecting a system from a SPREA analysis, the System Name and Mission/Condition Set name will come from Product 1 SPREA files.

The fields on the System Description menu must be entered in order. For example, if the user selects the System Type field and the Mission Area has not been identified, an error message will be displayed.

<u>User Actions:</u>

1. Mission Area. Next screen 0.7.

2. System Type. If the Mission Area has been defined, the next screen is 0.9. If the Mission Area has not yet been defined, an error message displays.

3. System Name. If the Mission Area and the System type have been defined, and the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the Mission Area and the System Type have been defined, and the user has chosen to identify a new system entirely from scratch, the next screen will be 0.22. If the Mission Area or System Type have <u>not</u> yet been defined, an error message displays.

4. Mission/Condition Set Name. If the Mission Area, the System Type, and the System Name have been defined, and the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the Mission Area, System Type, and System

Name have been defined, and the user has chosen to identify a new system entirely from scratch, the next screen will be 0.24. If the Mission Area, System Type, and System Name have not yet been defined, an error message displays.

<ESC> - Returns the user to screen 0.5.

PATH: MDA>Id System> MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: 2. System Type: 3. System Name: 4. Mission/Conditions Set Name:

Screen 0.6 - System Description Menu.

Screen 0.7 - Mission Area List. From this list, the user will select a Mission Area for the system under evaluation.

User Action:

The user will select a Mission Area from the list using normal menu selection procedures. Next screen 0.8.

<ESC> - Returns the user to screen 0.6.

Input File:

Product 5 Mission Area/System Type Taxonomy

PATH: MDA>Id System>

MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: 2. System Type: 3. System Name: 4. Mission/Conditions Set Name:

Mission Area List
1. Air Defense 2. Aviation 3. Combat Service Support 4. Close Combat Light 5. Close Combat Heavy 6. Fire Support

Screen 0.7 - **Mission Area List. From this list, the user will select a Mission Area for the system under evaluation.**

Screen 0.8 - System Description Menu with Mission Area selected.

From this screen, the user can select the System Type field.

User Action:

1. Mission Area. Next screen 0.7.

2. System Type. Next screen 0.9.

3. System Name. If the Mission Area and the System type have been defined, and the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the Mission Area and the System Type have been defined, and the user has chosen to identify a new system entirely from scratch, the next screen will be 0.22. If the Mission Area or System Type have not yet been defined, an error message displays.

4. Mission/Condition Set Name. If the Mission Area, the System Type, and the System Name have been defined, and the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the Mission Area, System Type, and System Name have been defined, and the user has chosen to identify a new system entirely from scratch, the next screen will be 0.24. If the Mission Area, System Type, and System Name have not yet been defined, an error message displays.

<ESC> - Returns the user to screen 0.5.

PATH: MDA>Id System>

MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: 3. System Name: 4. Mission/Conditions Set Name:

Screen 0.8 - **System Description Menu with Mission Area selected.**

Screen 0.9 - Aviation System Types List.

From this list the user will select a System Type category for the system under evaluation.

<u>User Action:</u>
The user will use normal menu selection procedures to choose a System Type from the list. Next screen 0.10.

<ESC> - Returns the user to screen 0.8.

<u>Input File:</u>
Product 5 Mission Area/System Type Taxonomy.

PATH: MDA>Id System>   MODE: Work

SYSTEM DESCRIPTION

1. Mission Area: Aviation
2. System Type:
3. System Name:
4. Mission/Conditions Set Name:

Aviation System Types

1. Attack Helicopters
2. Cargo Helicopters
3. Utility Helicopters
4. Scout Helicopters
5. Other Helicopters
6. Fixed Wing

Screen 0.9 - Aviation System Types List.

Screen 0.10 - System Description menu with Mission Area and System Type selected.

From this screen, the user can select the System Name field or either of the previously identified fields.

<u>User Action:</u>

1. Mission Area. Next screen 0.7.

2. System Type. Next screen 0.9.

3. System Name. If the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the user chose to identify a new system entirely from scratch, the next screen will be 0.22.

4. Mission/Condition Set Name. If the Mission Area, the System Type, and the System Name have been defined, and the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the Mission Area, System Type, and System Name have been defined, and the user has chosen to identify a new system entirely from scratch, the next screen will be 0.24. If the Mission Area, System Type, and System Name have not yet been defined, an error message displays.

<ESC> - Returns the user to screen 0.5.

PATH: MDA>Id System>

MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: 4. Mission/Conditions Set Name:

Screen 0.10 - **System Description menu with Mission Area and System Type selected.**

Screen 0.11 - List of SPREA System Names for the current System Type.

From this screen the user can select a system that has undergone a Product 1 SPREA analysis.

<u>User Actions:</u>

The user will use normal menu selection procedures to choose a system name from the list. Next screen is 0.12.

<ESC> - Returns the user to screen 0.10.

<u>Input File:</u>

Product 1 System files for the current System Type.

PATH: MDA>Id System>   MODE: Work

SYSTEM DESCRIPTION

1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name:
4. Mission/Conditions Set Name:

SPREA UTILITY HELICOPTERS

1. UH-1 Iroquois
2. UH-60 Black Hawk
3. UH-2C
4. .
5. .
6. .
7. .
8. .
9. .
0. .

MORE

Screen 0.11 - List of SPREA System Names for the current System Type.

Screen 0.12 - System Description Menu with Mission Area, System Type, and System Name identified.

From this menu, the user can select the Mission/Condition Set Name field or any of the previously selected fields.

User Actions:

1. Mission Area. Next screen is 0.7.

2. System Type. Next screen is 0.9.

3. System Name. If the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.11. If the user chose to identify a new system entirely from scratch, the next screen will be 0.22.

4. Mission/Condition Set Name. If the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen will be 0.13. If the user chose to identify a new system entirely from scratch, the next screen will be 0.24.

<ESC> Returns the user to screen 0.5.

PATH: MDA>Id System> MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: UH-60 Black Hawk 4. Mission/Conditions Set Name:

Screen 0.12 - System Description Menu with Mission Area, System Type, and System Name identified.

Screen 0.13 - SPREA Mission/Condition Set file names for the current System Name.

From this screen, the user can select a Mission/Condition Set file that was developed for the SPREA analysis, or view the contents of a SPREA Mission/Condition Set file.

User Actions:

select	When the select command is highlighted the user can use normal menu selection procedures to choose one of the listed files as the Mission/Condition Set file for the Product 5 MDA analysis. Next screen is 0.21.
view	When the view command is highlighted, the user can use normal menu selection procedures to view the contents of one of the listed files. Next screen is 0.14.
<ESC>	Returns the user to screen 0.12.

Input Files:

SPREA Conditions by System Types file names.

PATH: MDA>Id System>　　　　　　　　　　　　　　　　　　　　　　MODE: Work

SYSTEM DESCRIPTION

1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name: UH-60 Black Hawk
4. Mission/Conditions Set Name:

SPREA MISSION/CONDITION SETS
FOR: UH-60 BLACK HAWK

1. USNORMAL
2. USA1
3. EUROPE1
4. EUROPE2
5. MIDEAST1

select　　　　view

Screen 0.13 - **SPREA Mission/Condition Set file names for the current System Name.**

Screen 0.14 - SPREA Mission/Condition Set file menu.

From this screen, the user can choose to view typical or additional conditions for the system and mission identified in the SPREA analysis.

<u>User Actions:</u>

1. Typical Conditions. Next Screen is 0.15.

2. Additional Conditions. If Additional Conditions have been defined for the current system, the next Screen is 0.17. If no Additional Conditions have been defined for the current system, the next screen is 0.19.

<ESC> Returns the user to screen 0.13.

<u>Input File:</u>

Selected SPREA Conditions by System Type file.

PATH: MDA>Id System MODE: Work

SPREA MISSION/CONDITION SET

File name: USA1
System Type: Utility Helicopter
System Name: UH-60 Black Hawk
Mission: Transport Combat Troops

1. Typical Conditions
2. Additional Conditions

Screen 0.14 - SPREA Mission/Condition Set file menu.

Screen 0.15 - Typical Conditions menu for the selected Mission/Conditions Set file.

From this screen the user can select a category of typical conditions to view.

<u>User Actions:</u>
The user will use normal menu selection procedures to select a typical conditions category from the list. The next screen is an example of the typical environmental conditions 0.16.

<ESC> Returns the user to screen 0.14.

<u>Input File:</u>
Selected SPREA Conditions by System Type file.

PATH: MDA>Id System MODE: Work

SPREA MISSION/CONDITION SET
File name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk Mission: Transport Combat Troops
TYPICAL CONDITIONS
1. Environmental 2. Terrain 3. Target/Threat Related 4. Friendly Force Related

Screen 0.15 - **Typical Conditions menu for the selected Mission/Conditions Set file.**

Screen 0.16 - Typical Conditions screen for the selected category.

From this screen the user can view the parameters for the selected typical conditions category.

User Actions:

The only acceptable user action from this screen is the <ESC> key to return to the previous menu. The next screen is 0.15.

Input File:

Selected SPREA Conditions by System Type file.

PATH: MDA>Id System MODE: Work

SPREA MISSION/CONDITION SET
File name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk Mission: Transport Combat Troops
TYPICAL ENVIRONMENTAL CONDITIONS
Day/Night: night Visibility Type: clear Flight Rules/Conditions: VFR/VFC Climate Type: Basic/High Humid Altitude: 5000 ft. Electromagnetic Hazards: without

Screen 0.16 **Typical Conditions Screen for the Selected Category**

Screen 0.17 - Additional Conditions Menu. From this menu, the user can select an additional conditions category to view.

User Actions:

The user will use normal menu selection procedures to select an Additional Conditions category from the list. The next screen is an example of the additional environmental conditions screen 0.18.

Pressing the <ESC> key will return the user to screen 0.15.

PATH: MDA>Id System MODE: Work

```
SPREA MISSION/CONDITION SET

File name:  USA1
System Type:  Utility Helicopter
System Name:  UH-60 Black Hawk
Mission:  Transport Combat Troops

ADDITIONAL CONDITIONS

1. Environmental
2. Terrain
3. Target/Threat Related
4. Friendly Force Related
```

Screen 0.17 - **Additional Conditions Menu. From this menu, the user can select an additional conditions category to view.**

Screen 0.18 - Additional Conditions screen for the selected category.

From this screen the user can view the parameters for the selected additional conditions category.

User Actions:
The only acceptable user action from this screen is the <ESC> key to return to the previous menu. The next screen is 0.17.

Input File:
Selected SPREA Conditions by System Type file.

PATH: MDA>Id System MODE: Work

SPREA MISSION/CONDITION SET
File name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk Mission: Transport Combat Troops
ADDITIONAL ENVIRONMENTAL CONDITIONS
Special Environments: Mountain Wind Direction Type: Headwind Wind Direction-Measured (degrees): 0 Wind Velocity (knots): 30 Pressure (millibars): 1013 Temperature(degrees): 40 Precipitation: Rain Visibility (meters): 1500

Screen 0.18 - Additional Conditions screen for the selected category.

Screen 0.19 - No Additional Conditions message.

Displays when the user has selected to view Additional Conditions from a Mission/Condition Set SPREA file and none have been defined.

User Actions:

The only accepted user actions are pressing the <ENTER> or <ESC> keys. Either action will return the user to screen 0.14.

PATH: MDA>Id System MODE: Work

```
SPREA MISSION/CONDITION SET
-------------------------------------------
File name:  USA1
System Type:  Utility Helicopter
System Name:  UH-60 Black Hawk
Mission:  Transport Combat Troops
-------------------------------------------
No Additional Conditions have been
specified for this system

Press <ENTER> to Continue
```

Screen 0.19 - No Additional Conditions message.

Screen 0.21 - System Description screen with Mission Area, System Type, System Name, and Mission/Condition Set Name identified.

From this screen, the user can modify any of the fields or return to the Identify System menu.

<u>User Actions:</u>

1. Mission Area - Next screen is 0.7.

2. System Type - Next screen is 0.9.

3. System Name - If the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen is 0.11. If the chose to identify a new system entirely from scratch, the next screen is 0.22.

4. Mission/Condition Set Name - If the user has previously chosen to select a system from a Product 1 SPREA analysis, the next screen is 0.13. If the user chose to identify a new system entirely from scratch, the next screen is 0.24.

<ESC> Returns the user to the Identify System menu, 0.5.

PATH: MDA> Id System>   MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: UH-60 Black Hawk 4. Mission/Conditions Set Name: USA1

Screen 0.21 - System Description screen with Mission Area, System Type, System Name, and Mission/Condition Set Name identified.

Screen 0.22 - System Description menu with a flashing cursor displayed in the System Name field.

From this screen, the user can enter a system name for the current evaluation from the keyboard.

User Actions:

The system will wait for a string of allowable characters to be entered as the system name. The user will terminate the string by pressing the <ENTER> key. The system name must begin with an alpha character and can contain alpha, numeric, underscore, hyphen, and space characters. Characters in the System Name will be converted into a DOS file name via a collapsing algorithm (see below). If the System Name contains any characters that are not allowed, a tone will sound and an error message will display prompting the user with the rules for System Names. Next screen is 0.23.

<ESC> Returns the user to screen 0.10.

Algorithms:

The following algorithm will be used to collapse the System Name into a DOS file name:

- o remove all space characters
- o change everything to upper case
- o remove all vowels
- o remove characters at regular and predictable intervals until the name conforms to DOS file name rules

If the file name that results from the collapse algorithm matches an existing file name, a message will be displayed prompting the user to change the System Name slightly.

PATH: MDA>Id System>

MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: _ 4. Mission/Conditions Set Name:

Screen 0.22 - System Description menu with a flashing cursor displayed in the System Name field.

Screen 0.23 - System Description menu with Mission Area, System Type, and System Name identified.

From this screen, the user can select the Mission/Condition Set Name field or any of the previously identified fields.

User Actions:

1. Mission Area - Next screen is 0.7.

2. System Type - Next screen is 0.9.

3. System Name - Next screen is 0.22.

4. Mission/Condition Set Name - Next screen is 0.24.

<ESC> Returns the user to screen 0.5.

PATH: MDA>Id System>　　MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: UH-60 Black Hawk 4. Mission/Conditions Set Name:

Screen 0.23 - System Description menu with Mission Area, System Type, and System Name identified.

Screen 0.24 - List of Current Mission/Condition Set files for the identified System Name.

From this screen, the user can use normal (generic) menu selection strategies to select, insert, modify, copy, or delete a Mission/Condition Set file (see section 3.3).

User Actions:

select	When the select command is highlighted, the user can use normal selection procedures to choose one of the listed files as the Mission/Condition Set file for this analysis. Next screen is 0.21.
insert	When the insert command is highlighted, the user can use normal strategies to choose the file name after which a new file name will be inserted. Next screen is 0.25.
modify	When the modify command is highlighted, the user can use normal strategies to choose a file name for which the user wants to modify current mission/condition parameters. Next screen 0.30.
copy	When the copy command is highlighted, the user can use normal scrategies to choose a file name to copy. Next screen is 0.40.
delete	When the delete command is highlighted, the user can use normal strategies to choose a file name to delete from the disk storage. Next screen is 0.42.
<ESC>	Returns the user to screen 0.23.

Input Files:

Mission/Condition Set files that have been developed for the current system name.

PATH: MDA> Id System> MODE: Work

SYSTEM DESCRIPTION

1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name: UH-60 Black Hawk
4. Mission/Conditions Set Name:

CURRENT MISSION/CONDITION SETS
SETS FOR: UH-60 BLACK HAWK

1. USA1
2. USNORMAL
3. MIDEAST

select insert modify copy delete

Screen 0.24 - **List of Current Mission/Condition Set files for the identified System Name.**

Screen 0.25 - List of Mission/Condition Set files for the current system name with a flashing cursor indicating an insertion point for a new file name.

From this screen, the user can enter a new Mission/Condition Set file name.

<u>User Actions:</u>
The system will wait for a string of allowable characters to be entered as the new Mission/Condition Set file name. The user will terminate the string by pressing the <ENTER> key. The file name must begin with an alpha character and can contain up to eight alpha, numeric, underscore, and hyphen characters. All characters beyond the first eight will be truncated. If the Mission/Condition Set file name contains any characters that are not allowed, a tone will sound and an error message will display prompting the user with the rules for Mission/Condition Set names. Next screen is 0.26.

<ESC> Returns the user to screen 0.24.

PATH: MDA>Id System> MODE: Work

SYSTEM DESCRIPTION

1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name: UH-60 Black Hawk
4. Mission/Conditions Set Name:

CURRENT MISSION/CONDITION SETS
SETS FOR: UH-60 BLACK HAWK

1. USA1
2. –
3. USNORMAL
4. MIDEAST

select insert modify copy delete

Screen 0.25 - List of Mission/Condition Set files for the current system name with a flashing cursor indicating an insertion point for a new file name.

Screen 0.26 - Mission/Condition Set Definition menu.

From this screen, the user can choose to identify the Mission, the typical conditions, and/or the additional conditions for this evaluation.

User Actions:

1. Mission - Next screen is 0.27.

2. Typical Conditions - Next screen is 0.31.

3. Additional Conditions - Next screen is 0.36.

<ESC> Returns the user to screen 0.32.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk
1. Mission: 2. Typical Conditions 3. Additional Conditions

Screen 0.26 - Mission/Condition Set Definition menu.

Screen 0.27 - Mission/Condition Set Definition menu with "select" and "type-in" commands displayed.

From this screen, the user can choose to type in a mission name or select one from a list of missions for the current System Type.

<u>User Actions:</u>

select   Next screen is 0.28.

type-in   Next screen is 0.29.

<ESC> Returns the user to screen 0.26.

```
PATH: MDA>Id System                                                    MODE: Work

                 ------------------------------------------------------
                 |          MISSION/CONDITION SET DEFINITION          |
                 ------------------------------------------------------
                 |                                                    |
                 |       Name:   USA1                                 |
                 |       System Type:   Utility Helicopter            |
                 |       System Name:   UH-60 Black Hawk              |
                 ------------------------------------------------------
                 |                                                    |
                 |    1. Mission:                                     |
                 |    2. Typical Conditions                           |
                 |    3. Additional Conditions                        |
                 |                                                    |
                 ------------------------------------------------------
                 |        select                    type-in           |
                 ------------------------------------------------------
```

Screen 0.27 **Mission/Condition Set Definition Menu**

Screen 0.28 - List of missions for the identified System Type.

From this screen, the user can select a mission for this evaluation.

User Actions:

The user will use normal selection procedures to choose a mission name from the displayed list. Next screen is 0.30.

<ESC> Returns the user to screen 0.27.

Input File:

Product 5 Missions by System Type Taxonomy file.

```
PATH: MDA>Id System                                          MODE: Work

        MISSION/CONDITION SET DEFINITION

     Name:   USA1          Utility Helicopter Missions
     System Type:
     System Name:
                     1.  Transport Combat Troops
                     2.  Transport Logistical Supplies
  1.  Mission:       3.  Evacuate Casualties
  2.  Typical Condi  4.
  3.  Additional Co  5.

      select
```

Screen 0.28 - **List of missions for the identified System Type.**

Screen 0.29 - Mission/Condition Set Definition menu with a flashing cursor displayed in the mission field.

From this screen, the user can enter a mission name for this evaluation.

User Actions:

The user will enter a string of characters to describe the current mission. The string will be terminated by pressing the <ENTER> key. The next screen is 0.30.

<ESC> Returns the user to screen 0.27.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION	
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk	
1. Mission: _ 2. Typical Conditions 3. Additional Conditions	
select	type-in

Screen 0.29 - Mission/Condition Set Definition menu with a flashing cursor displayed in the mission field.

Screen 0.30 - Mission/Condition Set Definition menu with the mission identified.

From this screen, the user can choose to identify typical conditions, additional conditions, or change the mission name.

<u>User Actions:</u>

1. Mission - Next screen is 0.27.

2. Typical Conditions - Next screen is 0.31.

3. Additional Conditions - Next screen is 0.36.

<ESC> Next screen 0.32.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk
1. Mission: Transport Combat Troops 2. Typical Conditions 3. Additional Conditions

Screen 0.30 - Mission/Condition Set Definition menu with the mission identified.

Screen 0.31 - Mission/Condition Set Definition - Typical Conditions menu.

From this screen, the user can select a category of typical conditions to view/modify.

User Actions:

The user can use normal menu selection procedures to choose a category of typical conditions. The next screen (0.32) is an example of the Typical Environmental Conditions screen. The screens from the other category selections present the conditions for each category in the same format. The screens for each Typical Conditions category have default conditions highlighted.

<ESC> Returns the user to screen 0.30.

Input Files:

The Product 5 Conditions by System Type Taxonomy. See Section 4.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk
TYPICAL CONDITIONS
1. Environmental 2. Terrain 3. Target/Threat Related 4. Friendly Force Related

Screen 0.31 - **Mission/Condition Set Definition - Typical Conditions menu.**

Screen 0.32 - Mission/Condition Set Definition - Typical Environmental Conditions menu.

From this screen, the user can select environmental categories to modify conditions for each category.

User Actions:

Using normal menu selection procedures, the user will select a category for which he or she wants to change the conditions parameter. If the parameter for the selected field is one that can be selected from the conditions taxonomy, the user is presented with a list of the possible choices. The next screen (0.33) is an example of the condition parameters screen for the "Visibility Type" category. The screens from the other category selections present parameters for each category in the same format. The screens for each category have default or current conditions highlighted.

If the user selects a field from the Typical Environmental Conditions menu that must be input by the user, a flashing cursor will be displayed in that field. Screen 0.34 is an example of this kind of input.

<ESC> Returns the user to screen 0.31.

Input Files:

Product 5 Conditions by System Type Taxonomy.

PATH: MDA>Id System MODE: Work

```
MISSION/CONDITION SET DEFINITION

    Name:  USA1
    System Type:  Utility Helicopter
    System Name:  UH-60 Black Hawk

TYPICAL ENVIRONMENTAL CONDITIONS

 1. Day/Night:  night
 2. Visibility Type:  clear
 3. Flight Rules/Conditions:  VFR/VFC
 4. Climate Type:  Basic/High Humid
 5. Altitude:  5000 ft.
 6. Electromagnetic Hazards:  without
```

Screen 0.32 - Mission/Condition Set Definition - Typical Environmental Conditions menu.

Screen 0.33 - Visibility Type menu.

This is an example of how the parameters for each environmental conditions category is displayed. From this screen, the user can choose a category parameter.

User Actions:

The user can use normal procedures to select a parameter from the list. Next screen is 0.32. If the user selects the "other" option (which appears on all parameter category menus) he or she can type in a new condition parameter. Next screen 0.35.

<ESC> Returns the user to 0.32.

Input Files:

Product 5 Conditions by System Type Taxonomy.

PATH: MDA>Id System MODE: Work

```
MISSION/CONDITION SET DEFINITION

    Name:  USA1
    System Type:  Utility Helicopter
    System Name:  UH-60 Black Hawk

TYPICAL ENVIRONMENTAL CONDITIONS

  1. Day/Night:  night
  2. Visibility Type:  clear
  3. Flight Rules/Conditions:  VF
  4. Climate Type:  Basic/High Hu
  5. Altitude:  5000 ft.
  6. Electromagnetic Hazards:  wi
```

```
VISIBILITY TYPE

  1. clear
  2. fog
  3. haze
  4. smoke
  5. other
```

Screen 0.33 - Visibility Type menu.

Screen 0.34 - Mission/Condition Set Definition - Typical Environmental Conditions menu with a flashing cursor in the "Altitude:" field.

From this screen, the user can enter a value representing the expected altitude in which the system under evaluation must perform to accomplish the mission.

User Actions:

For each field that requires user input to establish the condition parameter, the system will wait for the appropriate input. For example, in this case, the system will wait for numeric characters that represent the number of feet of altitude. The user will terminate the input by pressing the <ENTER> key. If the input is not the appropriate character type (alpha or numeric) the system will display an error message. Next screen is 0.32.

<ESC> Returns the user to screen 0.32 and replaces the previous value.

PATH: MDA>Id System MODE: Work

```
MISSION/CONDITION SET DEFINITION

    Name:  USA1
    System Type:  Utility Helicopter
    System Name:  UH-60 Black Hawk

TYPICAL ENVIRONMENTAL CONDITIONS

 1. Day/Night:  night
 2. Visibility Type: smog
 3. Flight Rules/Conditions:  VFR/VFC
 4. Climate Type:  Basic/High Humid
 5. Altitude: _
 6. Electromagnetic Hazards:  without
```

Screen 0.34 - **Mission/Condition Set Definition - Typical Environmental Conditions menu with a flashing cursor in the "Altitude:" field.**

Screen 0.35 - Visibility Type menu with a flashing cursor displayed in a blank parameter field.

From this screen, the user can enter a condition parameter not shown as a menu option.

User Actions:
The user will use the normal editing keys to enter a string of characters that will be used as the new condition parameter. Pressing the <ENTER> key will terminate the input. Next screen 0.32.

<ESC> Returns the user to screen 0.32.

```
PATH: MDA>Id System                                                    MODE: Work

                    MISSION/CONDITION SET DEFINITION

          Name:  USA1
          System Type:  Utility Helicopter
          System Name:  UH-60 Black Hawk

                    TYPICAL ENVIRONMENTAL CONDITIONS

       1. Day/Night:  night                     VISIBILITY TYPE
       2. Visibility Type:  clear
       3. Flight Rules/Conditions:  VF
       4. Climate Type:  Basic/High Hu          1. clear
       5. Altitude:  5000 ft.                   2. fog
       6. Electromagnetic Hazards:  wi          3. haze
                                                4. smoke
                                                5. _
```

Screen 0.35 - **Visibility Type menu with a flashing cursor displayed in a blank parameter field.**

Screen 0.36 - Mission/Condition Set Definition - Additional Conditions menu.

From this screen, the user can select a category of additional conditions to view/modify.

User Actions:

The user can use normal menu selection procedures to choose a category of additional conditions. The next screen (0.37) is an example of the Additional Environmental Conditions screen. The screens from the other category selections present the conditions for each category in the same format. The screens for each Additional Conditions category have default conditions highlighted.

<ESC> Returns the user to screen 0.30.

Input Files:

The Product 5 Conditions by System Type Taxonomy. See Section 4.

```
PATH: MDA>Id System                                                  MODE: Work

+---------------------------------------------------------------+
|              MISSION/CONDITION SET DEFINITION                 |
+---------------------------------------------------------------+
|                                                               |
|        Name:   USA1                                           |
|        System Type:  Utility Helicopter                       |
|        System Name:  UH-60 Black Hawk                         |
+---------------------------------------------------------------+
|                    ADDITIONAL CONDITIONS                      |
+---------------------------------------------------------------+
|                                                               |
|               1. Environmental                                |
|               2. Terrain                                      |
|               3. Target/Threat Related                        |
|               4. Friendly Force Related                       |
|                                                               |
+---------------------------------------------------------------+
```

Screen 0.36 - Mission/Condition Set Definition - Additional Conditions menu.

Screen 0.37 - Mission/Condition Set Definition - Additional Environmental Conditions menu.

From this screen, the user can select environmental categories to modify conditions for each category.

User Actions:

Using normal menu selection procedures, the user will select a category for which he or she wants to change the conditions parameter. If the parameter for the selected field is one that can be selected from the conditions taxonomy, the user is presented with a list of the possible choices. The next screen (0.38) is an example of the condition parameters screen for the "Wind Direction Type" category. The screens from the other category selections present parameters for each category in the same format. The screens for each category have default or current conditions highlighted.

If the user selects a field from the Additional Environmental Conditions menu that must be input by the user, such as the temperature or wind velocity, a flashing cursor will be displayed in that field. Screen 0.39 is an example of this kind of input.

<ESC> Returns the user to screen 0.36.

Input Files:

Product 5 Conditions by System Type Taxonomy.

PATH: MDA)Id System MODE: Work

MISSION/CONDITION SET DEFINITION
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk
ADDITIONAL ENVIRONMENTAL CONDITIONS
Special Environments: Mountain Wind Direction Type: Headwind Wind Direction-Measured (degrees): 0 Wind Velocity (knots): 30 Pressure (millibars): 1013 Temperature(degrees): 40 Precipitation: Rain Visibility (meters): 1500

Screen 0.37 - Mission/Condition Set Definition - Additional Environmental Conditions menu.

Screen 0.38 - Wind Direction Type menu.

This is an example of how the parameters for each environmental conditions category is displayed. From this screen, the user can choose a category parameter.

User Actions:

The user can use normal procedures to select a parameter from the list. Next screen is 0.37. If the user selects the "other" option (which appears on all parameter category menus) he or she can type in a new condition parameter. Next screen 0.39.

<ESC> Returns the user to 0.37.

Input Files:

Product 5 Conditions by System Type Taxonomy.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION
Name: USA1 System Type: Utility Helicopter System Name: UH-60 Black Hawk
ADDITIONAL ENVIRONMENTAL CONDITIONS
Special Environments: Mountain Wind Direction Type: Headwind Wind Direction-Measured (degrees): 0 Wind Velocity (knots): 30 Pressure (millibars): 1013 Temperature(degrees): 40 Precipitation: Rain Visibility (meters): 1500

WIND DIRECTION TYPE
1. Headwind 2. Tailwind 3. Cross wind 4. No wind 5. Other

Screen 0.38 - Wind Direction Type menu.

Screen 0.39 - Wind Direction Type menu with a flashing cursor displayed in a blank parameter field.

From this screen, the user can enter a condition parameter not shown as a menu option.

<u>User Actions:</u>
The user will use the normal editing keys to enter a string of characters that will be used as the new condition parameter. Pressing the <ENTER> key will terminate the input. Next screen 0.37.

<ESC> Returns the user to screen 0.37.

PATH: MDA>Id System MODE: Work

MISSION/CONDITION SET DEFINITION

Name: USA1
System Type: Utility Helicopter
System Name: UH-60 Black Hawk

ADDITIONAL ENVIRONMENTAL CONDITIONS

Special Environments: Mountain
Wind Direction Type: Headwind
Wind Direction-Measured (degrees): 0
Wind Velocity (knots): 30
Pressure (millibars): 1013
Temperature(degrees): 40
Precipitation: Rain
Visibility (meters): 1500

WIND DIRECTION TYPE

1. Headwind
2. Tailwind
3. Cross wind
4. No wind
5. _

Screen 0.39 - Wind Direction Type menu with a flashing cursor displayed in a blank parameter field.

Screen 0.40 - List of Mission/Condition Set files for the current System Name with a flashing cursor in the space below the file to be copied.

From this screen, the user can enter a new name for the copied file.

User Actions:
The system will wait for a string of allowable characters to be entered as the copied Mission/Condition Set file name. The user will terminate the string by pressing the <ENTER> key. The file name must begin with an alpha character and can contain up to eight alpha, numeric, underscore, and hyphen characters. All characters beyond the first eight will be truncated. If the Mission/Condition Set file name contains any characters that are not allowed, a tone will sound and an error message will display prompting the user with the rules for naming Mission/Condition set files. Next screen is 0.41.

<ESC> Returns the user to screen 0.23.

Input Files:
Product 5 Mission/Condition Set files.

PATH: MDA>Id System>   MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name: UH-60 Black Hawk
4. Mission/Conditions Set Name:

CURRENT MISSION/CONDITION SETS SETS FOR: UH-60 BLACK HAWK
1. USA1
2. –
3. USNORMAL
4. MIDEAST
select insert modify copy delete

Screen 0.40 - **List of Mission/Condition Set files for the current System Name with a flashing cursor in the space below the file to be copied.**

Screen 0.41 - List of Mission/Condition Set files with the copied file name inserted after the source file.

From this screen, the user can use normal selection procedures to initiate any of the available commands.

<u>User Actions:</u>
See the description of user actions for screen 0.24.

PATH: MDA>Id System> MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: UH-60 Black Hawk 4. Mission/Conditions Set Name:

CURRENT MISSION/CONDITION SETS SETS FOR: UH-60 BLACK HAWK
1. USA1 2. USA2 3. USNORMAL 4. MIDEAST
select insert modify copy delete

Screen 0.41 - List of Mission/Condition Set files with the copied file name inserted after the source file.

Screen 0.42 - Message requiring the user to confirm the delete operation.

From this screen, the user can either confirm or cancel the delete request.

User Actions:

y causes the deletion of the currently highlighted Mission/Condition Set file. Next screen is 0.43.

n cancels the delete request. Next screen is 0.24.

<ESC> cancels the delete request. Next screen is 0.24.

```
PATH: MDA>Id System>                                                    MODE: Work

┌──────────────────────────────────────────────┐
│              SYSTEM DESCRIPTION              │
├──────────────────────────────────────┌──────────────────────────────────┐
│                                      │ CURRENT MISSION/CONDITION SETS   │
│  1.  Mission Area: Aviation          │ SETS FOR: UH-60 BLACK HAWK       │
│  2.  System Type: Utility Helicopters├──────────────────────────────────┤
│  3.  System Name: UH-┌──────────────────────────────┐                  │
│  4.  Mission/Conditio│  OK To Delete File from Disk │                  │
│                      │                              │MAL               │
└──────────────────────│          Y or N ?            │ST                │
                       │                              │                  │
                       └──────────────────────────────┘                  │
                                       ├──────────────────────────────────┤
                                       │select insert modify copy delete  │
                                       └──────────────────────────────────┘
```

Screen 0.42 - **Message requiring the user to confirm the delete operation.**

Screen 0.43 - List of Mission/Condition Set files with the deleted file removed.

From this screen, the user can use normal selection procedures to initiate any of the available commands.

<u>User Actions:</u>

See the description of user actions for screen 0.24.

PATH: MDA>Id System> MODE: Work

SYSTEM DESCRIPTION
1. Mission Area: Aviation 2. System Type: Utility Helicopters 3. System Name: UH-60 Black Hawk 4. Mission/Conditions Set Name:

CURRENT MISSION/CONDITION SETS SETS FOR: UH-60 BLACK HAWK
1. USA1 2. USNORMAL 3. MIDEAST
select insert modify copy delete

Screen 0.43 **List of Mission/Condition Set Files**

Screen 0.50 - Resume MDA Analysis menu.

From this screen, the user can type-in or select the System Name and the Mission/Condition Set name for which to resume analysis activities.

User Actions:

1. System name - When "type-in" is the highlighted command, a flashing cursor will be displayed in the system name field. Next screen is 0.51. When "select" is the highlighted command, the system will display a list of currently saved System Names. Next screen is 0.52.

2. Mission/Condition Set name - When this field is selected and the user has not identified the system name, a tone will sound and an error message will be displayed indicating that the system name must be entered first.

<ESC> Returns the user to screen 0.3.

Input Files:

Product 5 System Files. Product 5 Mission/Condition Set Files.

PATH: MDA>Id System MODE: Work

RESUME MDA ANALYSIS
1. System name: 2. Mission/Condition Set name:
type-in select

Screen 0.50 - Resume MDA Analysis menu.

Screen 0.51 - Resume MDA Analysis menu with flashing cursor displayed in the System name field.

From this screen, the user can type-in the name of the system for which he or she wants to resume the analysis.

User Actions:

The user will use normal editing keys and procedures to enter the system name. Input will be terminated by pressing the <ENTER> key. Next screen 0.53. If the name that the user enters does not exist on the current storage medium, an error message indicating such will display. Next screen 0.50.

<ESC> Returns the user to screen 0.50.

Input Files:

Product 5 System Files.

```
PATH: MDA>Id System                                                    MODE: Work

                 +----------------------------------------------+
                 |               RESUME MDA ANALYSIS            |
                 +----------------------------------------------+
                 |                                              |
                 |   1. System name: _                          |
                 |   2. Mission/Condition Set name:             |
                 |                                              |
                 +----------------------------------------------+
                 |          type-in             select          |
                 +----------------------------------------------+
```

Screen 0.51 - **Resume MDA Analysis menu with flashing cursor displayed in the System name field.**

Screen 0.52 - List of current System Names.

From this screen, the user can select a system name for which to resume the analysis.

<u>User Actions:</u>

Using normal selection procedures, the user will choose a system name from the list for the analysis. Next screen is 0.53.

<ESC> Returns the user to screen 0.50.

<u>Input Files:</u>

Product 5 System Files.

```
PATH: MDA>Id System                                                   MODE: Work

                 RESUME MDA ANALYSIS

  1. System name:
  2. Mission/Condition Set na

          type-in             sel

                                        CURRENT SYSTEM NAMES

                                        1. UH-60 Black Hawk
                                        2. UH-1 Iroquois
                                        3. AH-1 Apache
                                        4. AH-1S Cobra
                                        5. M60 Tank
```

Screen 0.52 **List of Current System Names**

Screen 0.53 - Resume MDA Analysis with System Name identified.

From this screen, the user can choose to type-in or select a Mission/Condition Set file name for the analysis or change the System Name.

User Actions:

1. System name - When "type-in" is the highlighted command, a flashing cursor will be displayed in the system name field. Next screen is 0.51. When "select" is the highlighted command, the system will display a list of currently saved System Names. Next screen is 0.52.

2. Mission/Condition Set name - When "type-in" is the highlighted command, the system will display a flashing cursor in the Mission/Condition Set name field. Next screen is 0.54. When "select" is the highlighted command, the system will display a list of the currently saved Mission/Condition Set files for the identified System Name. Next screen is 0.58.

<ESC> Returns the user to screen 0.3.

PATH: MDA>Id System MODE: Work

RESUME MDA ANALYSIS
1. System name: UH-60 Black Hawk 2. Mission/Condition Set name:
type-in select

Screen 0.53 - Resume MDA Analysis with System Name identified.

Screen 0.54 - Resume MDA Analysis menu with flashing cursor displayed in the Mission/Condition Set name field.

From this screen, the user can type-in the name of the Mission/Condition Set file name for the resumed analysis.

<u>User Actions:</u>

The user will use normal editing keys and procedures to enter the file name. Input will be terminated by pressing the <ENTER> key. Next screen 0.56. If the name that the user enters does not exist on the current storage medium, an error message indicating such will display. Next screen 0.53.

<ESC> Returns the user to screen 0.53.

PATH: MDA>Id System MODE: Work

RESUME MDA ANALYSIS
1. System name: UH-60 Black Hawk 2. Mission/Condition Set name: _
type-in select

Screen 0.54 - Resume MDA Analysis menu with flashing cursor displayed in the Mission/Condition Set name field.

Screen 0.56 - Resume MDA Analysis menu with the System and the Mission/Condition Set names identified.

From this screen, the user can modify either the System name or the Mission/Condition Set name or return to the MDA Flowchart menu.

<u>User Actions:</u>

1. System name - When "type-in" is the highlighted command, a flashing cursor will be displayed in the system name field. Next screen is 0.51. When "select" is the highlighted command, the system will display a list of currently saved System Names. Next screen is 0.52.

2. Mission/Condition Set name - When "type-in" is the highlighted command, the system will display a flashing cursor in the Mission/Condition Set name field. Next screen is 0.54. When "select" is the highlighted command, the system will display a list of the currently saved Mission/Condition Set files for the identified System Name. Next screen is 0.58.

<ESC> Returns the user to screen 0.3.

```
PATH: MDA>Id System                                              MODE: Work

                 +--------------------------------------------+
                 |            RESUME MDA ANALYSIS             |
                 +--------------------------------------------+
                 |                                            |
                 |   1. System name:  UH-60 Black Hawk        |
                 |   2. Mission/Condition Set name:  USA1     |
                 |                                            |
                 |                                            |
                 +--------------------------------------------+
                 |        type-in           select            |
                 +--------------------------------------------+
```

Screen 0.58 - **Resume MDA Analysis menu with the System and the Mission/Condition Set names identified.**

Screen 0.58 - Current Mission/Condition Sets for the identified System Name.

From this screen, the user can select, insert, modify, copy, or delete Mission/Condition Set files.

User Actions:

The commands and processes that are available are identical to those described for screen 0.24.

select Next screen is 0.56.

insert, modify, copy, delete - See screen 0.24.

<ESC> Returns the user to screen 0.53.

```
PATH: MDA>Id System                                                   MODE: Work

                 ┌────────────────────────────────────────┐
                 │          RESUME MDA ANALYSIS            │
                 ├────────────────────────────────────────┤
                 │                                         │
                 │  1. System name:  UH-┌─────────────────────────────────┐
                 │  2. Mission/Condition│  CURRENT MISSION/CONDITION SETS  │
                 │                      │  SETS FOR: UH-60 BLACK HAWK      │
                 │                      ├─────────────────────────────────┤
                 ├──────────────────────┤                                  │
                 │       type-in        │        1. USA1                   │
                 └──────────────────────┤        2. USNORMAL               │
                                        │        3. MIDEAST                │
                                        │                                  │
                                        ├─────────────────────────────────┤
                                        │select  insert  modify  copy  delete│
                                        └─────────────────────────────────┘
```

Screen 0.53 - Current Mission/Condition Sets for the identified System Name.

Screen 0.59 - MDA Utilities menu.

From this menu, the user can use normal menu selection procedures to choose a utility function.

User Action:

1. Directory - Next screen is 0.60.

2. Delete - Next screen is 0.61.

3. Copy - Next screen is 0.62.

4. Print - Next screen is 0.63.

5. Settings - Next screen is 0.65.

<ESC> Returns the user to screen 0.2.

```
PATH: MDA>Utilities                                          MODE: Work

                 ┌──────────────────────────────┐
                 │   MDA System Utilities       │
                 ├──────────────────────────────┤
                 │                              │
                 │   1. Directory Listing       │
                 │   2. Delete Files            │
                 │   3. Copy Files              │
                 │   4. Print Files             │
                 │   5. Settings                │
                 │                              │
                 └──────────────────────────────┘
```

Screen 0.59 - MDA Utilities menu.

Screen 0.60 - Directory listing of all system names currently being evaluated.

This is an informational screen. The only user action is to page back and forth through the list of saved system files.

User Actions:

<PgDn> Displays the next page of system names stored on the current disk (if there is one).

<PgUp> Displays the previous page of system names stored on the current disk (if there is one).

<ESC> Returns the user to screen 0.59.

PATH: MDA>Utilities MODE: Work

MDA SYSTEMS DIRECTORY	
System Name:	Date Created:
1. UH-60 Black Hawk	02/03/87
2. UH-1 Iroquois	02/10/87
3. AH-1 Apache	02/11/87
4. AH-1S Cobra	03/10/87
5. M60 Tank	03/26/87

Screen 0.60 - **Directory listing of all system names currently being evaluated.**

Screen 0.61 - Delete System Files message.

Prompts the user to enter the name of the system whose files that he or she wants to delete. This utility will delete all of the files that are associated with the system name entered.

<u>User Actions:</u>
Using normal editing keys and procedures the user will enter the name of the system files to be deleted. Next screen is 0.61A.

<ESC> Returns the user to screen 0.59.

PATH: MDA>Utilities MODE: Work

DELETE SYSTEM FILES
Enter System Name to delete: _

Screen 0.61 - Delete System Files message.

Screen 0.61A - Delete Verification message.

Before the files for any system can be deleted, the user must verify the delete request.

<u>User Actions:</u>

Y Confirms the delete request. Next screen is 0.59.

N Cancels the delete request. Next screen is 0.59.

<ESC> Cancels the delete request. Next screen is 0.59.

PATH: MDA>Utilities MODE: Work

DELETE SYSTEM FILES

Enter System Name to delete: UH-60 Black Hawk

WARNING !

If you continue this operation, all of files associated with the current System name will be permanently deleted from the disk.

OK to continue ? Y or N

Screen 0.61A - Delete Verification message.

Screen 0.62 - Copy message.

Prompts the user to enter the name of a system whose files he or she wants to copy. The copy utility will copy all of the files that are associated with a system name.

<u>User Actions:</u>

Using normal editing keys and procedures, the user will enter a system name. Next screen is 0.62A.

<ESC> Returns the user to screen 0.59.

PATH: MDA>Utilities MODE: Work

COPY SYSTEM FILES
Enter Source System Name:___

Screen 0.62 - Copy message.

Screen 0.62A - Copy message - target system name.

After the user has enter the name of a system to copy, the system will prompt the user to enter a target system name for the new files.

<u>User Actions:</u>
Using normal editing keys and procedures, the user will enter a target system name.

<ESC> Returns the user screen 0.59.

PATH: MDA>Utilities MODE: Work

COPY SYSTEM FILES
Enter Source System Name: UH-60 Black Hawk Enter Target System Name: UH-60 Black Hawk2

Screen 0.62A - Copy message - target system name.

Screen 0.63 - Print File menu.

Displays a list of all of the files stored on the current hard disk. From this list, the user can select a file to print.

User Actions:

Using normal menu selection procedures, the user will choose a file to print. Next screen is 0.63A.

<ESC> Returns the user to screen 0.59.

PATH: MDA>Utilities MODE: Work

PRINT SYSTEM FILES		
File Name:	Size:	Date Created:
1. UH-60.CMP	21344	12/25/87
2. UH-60.SCN	16238	12/28/87
3. M60.CMP	12899	10/29/87
4. M60.SCN	8765	11/01/87
5. M60.TSK	10998	11/14/87
6. AH-1S.CMP	123688	11/24/87
select		

Screen 0.63 - Print File menu.

Screen 0.63A - Print File menu with "PRINTING" message displayed.

<u>User Actions:</u>

None Next screen is 0.59.

PATH: MDA>Utilities MODE: Wait

PRINT SYSTEM FILES

File Name:	Size:	Date Created:
1. UH-60.CMP		12/25/87
2. UH-60.SCN		12/28/87
3. M60.CMP	PRINTING	10/29/87
4. M60.SCN		11/01/87
5. M60.TSK		11/14/87
6. AH-1S.CMP	123688	11/24/87

select

Screen 0.63A - Print File menu with "PRINTING" message displayed.

Screen 0.64 - Settings

User Actions:

The system will ask user to identify the correct MDA settings for the type of printers they have, any relevant system configuration information, and to identify forground and background colors for all of the menus and command bar structures. The user will be able to revert to the default settings at any time. When the user has finished modifying the default settings, he or she is returned to screen 0.59.

<ESC> Returns the user to screen 0.59.

3.5 STEPS IN APPLYING THE MAINTENANCE MANPOWER ANALYSIS AID

In order to use the MMAA to analyze the maintenance requirements for a proposed new system, the user will perform four general activities:

- Estimate the maintenance parameters for each component in the system.
- Identify the maintenance scenario for the evaluation.
- Execute the maintenance requirements simulation model.
- Analyze the results of the simulation model.

In order to accomplish each of the four general activities listed above, the user will follow the eight specific steps listed below.

1. Enter the system component names and all available maintenance parameters from the contractor's system design.
2. Match system components and parameters from the contractor's design to government baseline estimates from comparable fielded systems.
3. Identify descrepancies between government baseline estimates and the contractor's estimates of component maintenance parameters.

4. Resolve the identified descrepancies to determine the "best estimates" of component maintenance parameters.

5. Identify/develop parameters for each maintenance scenario to be analyzed in terms of maintenance manpower requirements.

6. Execute the computer simulation to calculate the maintenance manhour and headcount requirements for the proposed system.

7. Evaluate the results of the simulation in terms of the maintenance jobs that are required, the tasks that make up each job, the number of maintenance manhours required, the maintenance headcount requirements, system availability, and system reliability. These requirements are compared to the system performance requirements that were identified in the Product 1 SPREA analysis and the manpower constraints that were identified during the Product 2 MCEA analysis.

8. Investigate potential solutions to maintenance deficiencies by modifying parameters and re-running the simulation model.

3.5.1 STEP 1 - Enter the system component names and all available Component Maintenance Parameters (required by the MMAA) from the contractor's system design.

3.5.1.1 Input

<u>External Input:</u> The contractor's system design documentation that is submitted for evaluation the Program

Manager's office. Not all of the information required for the MMAA analysis will be contained in the contractor's documentation. However, this documentation must, at least, contain a list of all components in the proposed new system. The contractor's documentation should also include a Logistical Support Analysis Record that should indicate the quantitative, qualitative, and procedural requirements for all planned and corrective maintenance activities. The user will obtain, from the system design, as many of the following parameters for each component:

- the functional system to which the component belongs.
- the component name
- each maintenance action required
- the type of maintenance personnel required to perform the maintenance (e.g. electrican, MOS/Skill level)
- the type of maintenance (planned or corrective)
- the mean operational units between failure
- the operational units metric (miles, time, rounds fire)
- maintenance mean time to repair
- the maintenance organization (ds, gs, etc.)
- an indication of whether or not failure of the component will cause the mission to be aborted.

NOTE: This description of input data from the system design represents a "best case" situation. In reality, the contractor may supply only a portion of the above data.

Internal Input: The MMAA software and Component Maintenance Parameter Templates.

3.5.1.2 Process

The user/analyst will gain access to the MMAA from the MDA Flowchart Menu. The screen that the user will see, upon accessing the MMAA is flowchart menu of the four major activities included in the MMAA. The first four steps in the overall process can be performed iteratively by the user to identify all of the Component Maintenance Parameters in the system under evaluation. For example, the user may want to perform Step 1 for all functional systems in the system design and then move on to Step 2 for all functional systems and continue until all four Steps have been performed for all of the functional systems. However, it will also be possible for the user to perform Steps 1-4 for the first functional system and then move on to the next functional system.

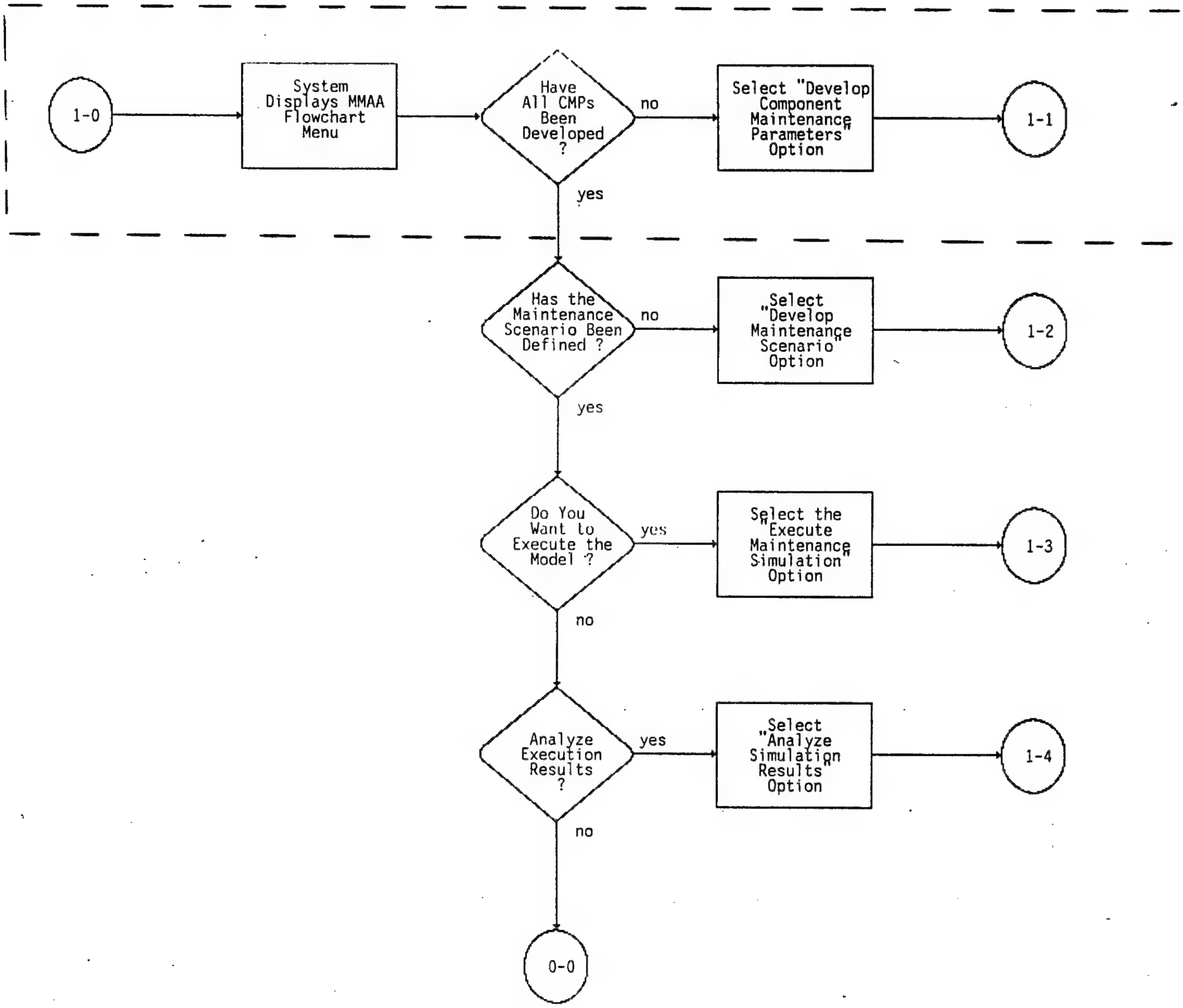
To begin step 1, the analyst will choose the "Develop Component Maintenance Parameters" option from the flowchart menu. After selection this option, the user is presented with a menu that lists all of the functional systems within the major system for which Component Maintenance Parameters have been developed. The first time the user accesses the MMAA, the list will be blank. From this screen, the user can insert a new functional system, modify the components and parameters for an existing functional system, copy, or delete an existing functional system.

When the user inserts a new functional system or selects to modify an existing functional system, the MMAA will display a Component Maintenance Parameters Template for that functional system. The CMP Template is a spreadsheet-like matrix that has a space for component names in the leftmost column. The top row of the matrix contains column headings that identify the maintenance parameters required

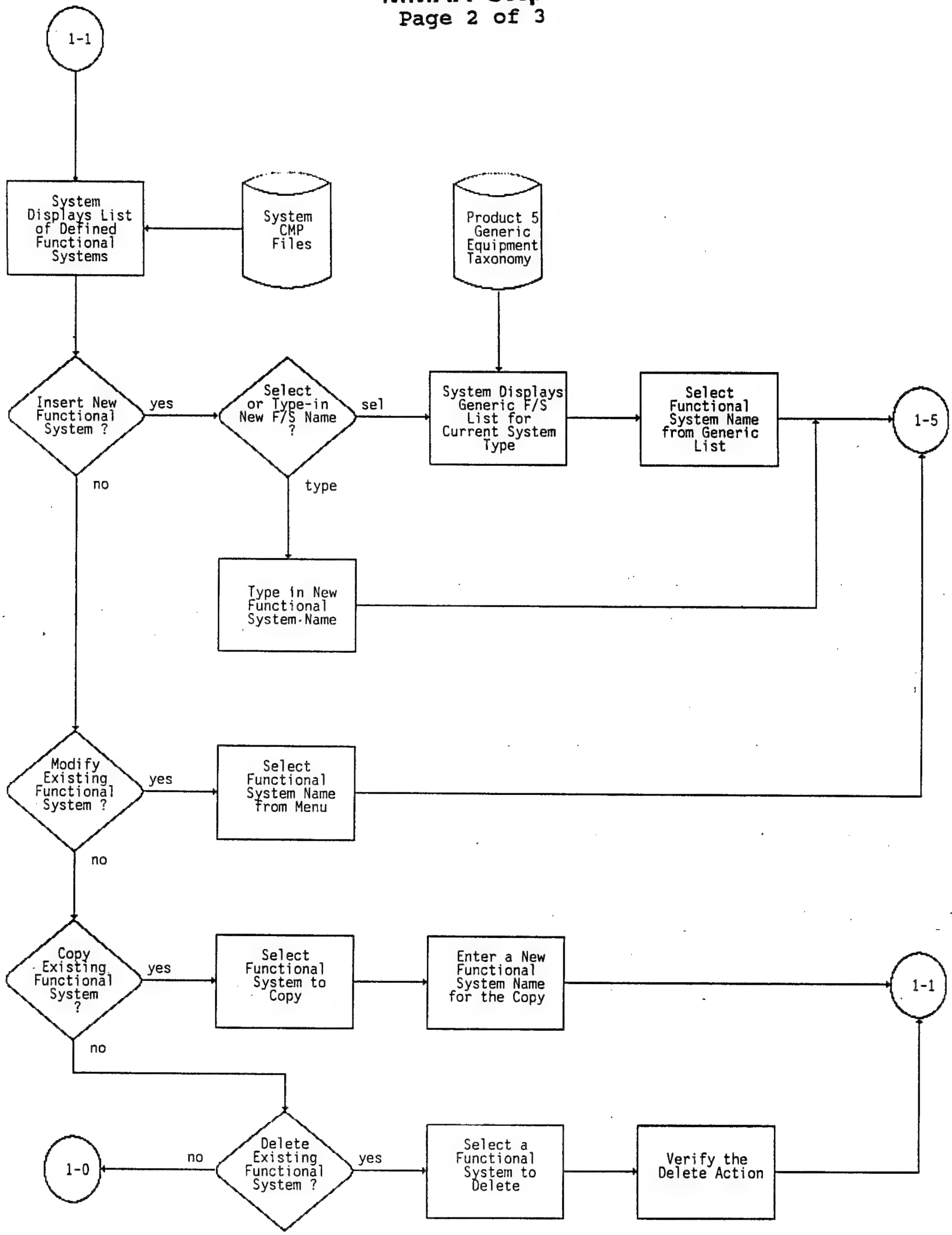
for each component. The cells that are the intersection of a row (component name) and column (maintenance parameter) are divided into an upper and lower portion. In the upper portion, the user will enter maintenance parameter estimates that are available in the system design. The lower portion will be used to enter government baseline estimates in a later step. The analyst will continue to add new functional systems and enter the component names and available Component Maintenance Parameters for each new functional system until all of the components in the system design have been entered.

The flow diagrams of the process of performing step 1 are included on the following pages.

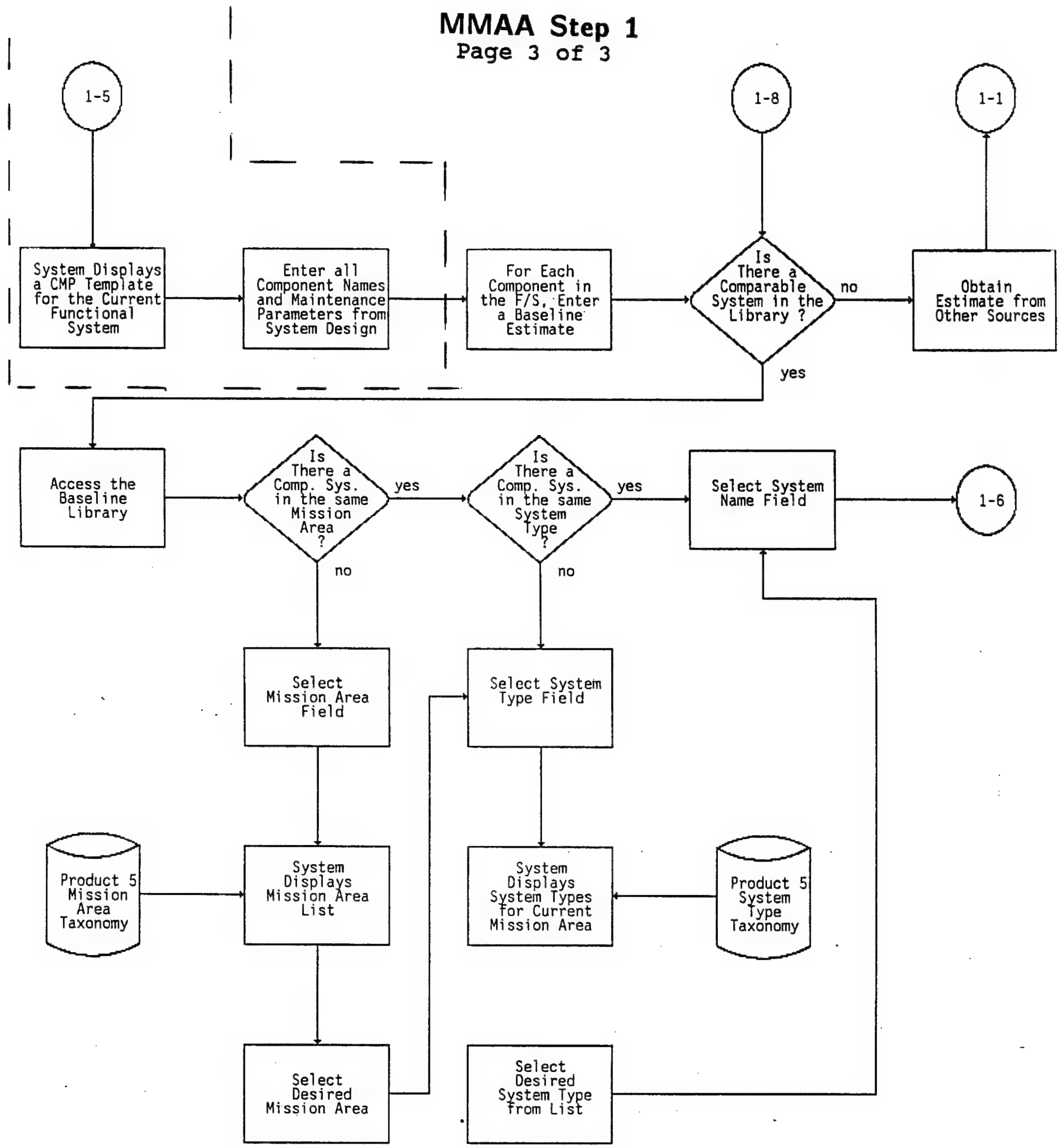
MMAA Step 1
Page 1 of 3



MMAA Step 1


1-1
System Displays List of Defined Functional Systems
System CMP Files
Product 5 Generic Equipment Taxonomy
Insert New Functional System ?
yes
Select or Type-in New F/S Name ?
sel
System Displays Generic F/S List for Current System Type
Select Functional System Name from Generic List
1-5
no
type
Type in New Functional System Name
Modify Existing Functional System ?
yes
Select Functional System Name from Menu
no
Copy Existing Functional System ?
yes
Select Functional System to Copy
Enter a New Functional System Name for the Copy
1-1
no
1-0
no
Delete Existing Functional System ?
yes
Select a Functional System to Delete
Verify the Delete Action

MMAA Step 1


1-5
1-8
1-1
System Displays a CMP Template for the Current Functional System
Enter all Component Names and Maintenance Parameters from System Design
For Each Component in the F/S, Enter a Baseline Estimate
Is There a Comparable System in the Library ?
no
yes
Obtain Estimate from Other Sources
Access the Baseline Library
Is There a Comp. Sys. in the same Mission Area ?
yes
no
Is There a Comp. Sys. in the same System Type ?
yes
no
Select System Name Field
1-6
Select Mission Area Field
Select System Type Field
Product 5 Mission Area Taxonomy
System Displays Mission Area List
System Displays System Types for Current Mission Area
Product 5 System Type Taxonomy
Select Desired Mission Area
Select Desired System Type from List

3.5.1.3 Output

The output of this step will be a set of Component Maintenance Parameter Templates that are stored as records in the Component Maintenance Parameters data file for the current system. There will be one Template (record) for each functional system in the system design. Each Template will contain a list of the component names and the Component Maintenance Parameters for each component that are available in the system design.

3.5.1.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.1 - Flowchart Menu for the MMAA.

This screen is a menu of the activities that the user will perform in conducting a maintenance manpower requirements analysis for a new system design. The arrows on the flowchart menu indicate the order in which the activities will be performed. The use can use the arrow keys and normal selection procedures to make a selection.

<u>User Actions:</u>

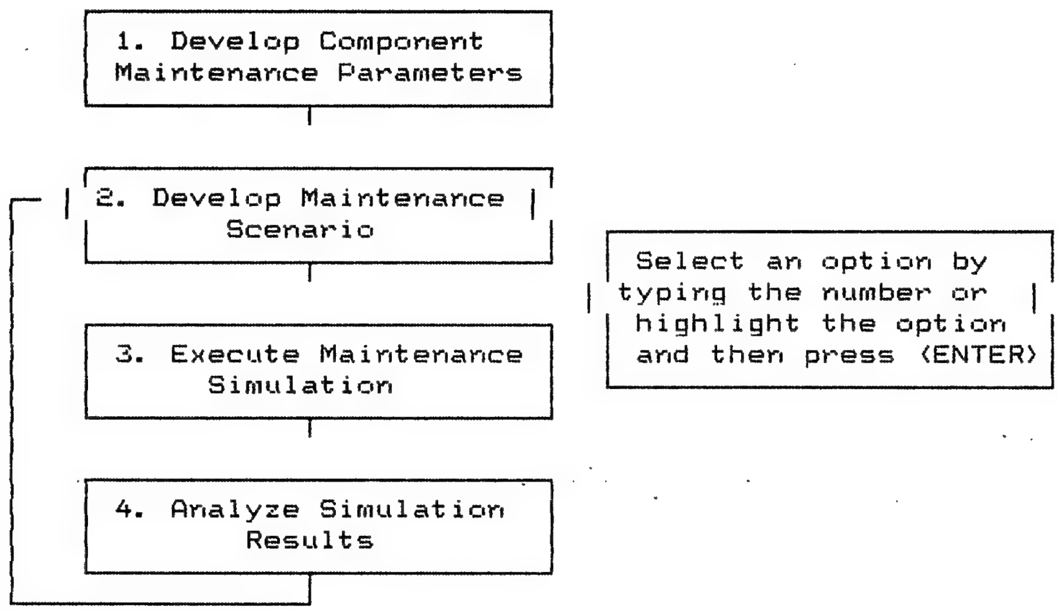
1. Develop Component Maintenance Parameters. Next screen is 1.5.

2. Develop Maintenance Scenario. When this option is selected, the system will read the functional system and component names from the Component Maintenance Parameter file. Therefore, this option should not be selected until all of the Component Maintenance Parameters have been entered (option 1). Next screen is 1.68. If no Component Maintenance Parameters have been developed, an warning message will display indicating that the CMPs should be entered first.

3. Execute Maintenance Simulation. Next screen is 1.81. If no Component Maintenance Parameters have been developed or if no Maintenance Scenario file has been developed, an error message displays.

4. Analyze Simulation Results. The simulation model must have been executed prior to selecting this option. Next screen is 1.89. If the simulation has not been executed for this system. An error message indicating such will display.

FLOWCHART FOR THE MAINTENANCE MANPOWER ANALYSIS AID



Screen 1.1 - Flowchart Menu for the MMAA.

Screen 1.5 - List of Functional Systems.

This screen list all of the currently created (saved) functional system templates. The first time the user accesses this screen the list will be blank. From this screen, the user can use normal (generic) menu/command selection strategies to insert, modify, copy, or delete a functional system template.

<u>User Actions:</u>

insert — When the insert command is highlighted, the user can use normal strategies to choose the functional system name after which a new functional system will be inserted. Next screen is 1.10.

modify — When the modify command is highlighted, the user can use normal stragegies to choose a functional system for which to add or modify components and/or maintenance parameters. When a name system is selected the Component Maintenance Parameter Template for that functional system will display. Next screen is 1.31.

copy — When the copy command is highlighted, the user can make and exact copy of a the selected funcional system template under a new name. The name of the new system is displayed directly below the copied system in the list. Next screen is 1.22.

delete — When the delete command is highlighted, the user can use normal strategies to choose a

functional system template to delete from the disk. Next screen is 1.29.

<ESC> Returns the user to screen 1.1.

Input File:
Component Maintenance Parameter file for the identified system.

PATH: MDA>MMAA>Component Maintenance Parameters> MODE: Work

LIST OF FUNCTIONAL SYSTEMS
1. Hydraulics System 2. Electrical System 3. Communications System
insert modify copy delete

Screen 1.5 - List of Functional Systems.

Screen 1.10 - List of Functional Systems with a blank field displayed at the insert position and the "type-in" and "select" commands displayed.

From this screen, the user can choose to type-in a new functional system name or to select a new functional system name from a generic list of functional systems for the identified System Type.

<u>User Actions:</u>

type-in — When this is the selected command, a flashing cursor will be displayed at the insertion point. Next screen is 1.11.

select — When this is the selected command, a list of generic functional systems for the current System Type displays. Next screen is 1.12.

<ESC> — Returns the user to screen 1.5.

PATH: MDA>MMAA>Component Maintenance Parameters> MODE: Work

LIST OF FUNCTIONAL SYSTEMS
1. Hydraulics System 2. Electrical System 3. Communications System 4.
type-in select

Screen 1.10 - **List of Functional Systems with a blank field displayed at the insert position and the "type-in" and "select" commands displayed.**

Screen 1.11 - List of Functional Systems with a flashing cursor displayed at the insertion point.

From this screen, the user can type-in the name of a new functional system.

<u>User Actions:</u>

The user will use normal editing keys and procedures to enter the name of a functional system of components for the system under evaluation such as the avionics system or the electrical system. The string of characters that constitute the name will be terminated by pressing the <ENTER> key. When the new system name has been entered, the system will display a blank Component Maintenance Parameter Template for the inserted functional system name. Next screen is 30A??

<ESC> Returns the user to screen 1.10.

PATH: MDA>MMAA>Component Maintenance Parameters>   MODE: Work

LIST OF FUNCTIONAL SYSTEMS
1. Hydraulics System 2. Electrical System 3. Communications System 4. _
type-in   select

Screen 1.11 - List of Functional Systems with a flashing cursor

Screen 1.12 - Generic Functional Systems List for the identified System Type.

From this screen, the user can select a name for the functional system template to be inserted.

<u>User Actions:</u>
Using normal menu selection procedures, the user can choose a functional system name. Next screen is 1.30A.

<ESC> Returns the user to screen 1.10.

<u>Input File:</u>
Product 5 Generic Equipment by System Type file.

PATH: MDA>MMAA>Component Maintenance Parameters> MODE: Work

LIST OF FUNCTIONAL SYSTEMS

1. Hydraulics System
2. Electrical System
3. Communications System
4.

type-in select

GENERIC FUNCTIONAL SYSTEM LIST
FOR: UTILITY HELICOPTERS

1. Hydraulic System
2. Electrical System
3. Communications System
4. Engine
5. .
6. .
7. .
8. .
9. .
0. .
More

Screen 1.12 - Generic Functional Systems List for the identified System Type.

Screen 1.22 - List of Functional Systems with a flashing cursor displayed in the field directly below the Functional System Template to be copied.

From this screen, the user can enter the name of a new functional system.

User Actions:

Using normal editing keys and procedures, the user can enter a new functional system name for the copy. Next screen is 1.23.

<ESC> Returns the user to screen 1.5.

PATH: MDA>MMAA>Component Maintenance Parameters> MODE: Work

LIST OF FUNCTIONAL SYSTEMS
1. Hydraulics System 2. Electrical System 3. Communications System 4. Engine 5. _
insert modify copy delete

Screen 1.22 - List of Functional Systems with a flashing cursor displayed in the field directly below the Functional System Template to be copied.

Screen 1.23 - List of Functional Systems with a delete verification message displayed.

From this screen, the user must either verify or cancel the delete command.

<u>User Actions:</u>

Y Confirms the delete operation. Next screen is 1.5.

N Cancels the delete request. Next screen is 1.5.

<ESC> Cancels the delete request. Next screen is 1.5.

```
PATH: MDA>MMAA>Component Maintenance Parameters>                    MODE: Work

     LIST OF FUNCTION
  
  1. Hydraulics System   WARNING:  If you delete a
  2. Electrical System   functional system, you'll
  3. Communications Sy   also delete all of the
  4. Engine              components and parameters
  5. Engine2             associated with it.

                         OK to delete ? (y or n)

   insert    modify    copy    delete
```

Screen 1.23 - List of Functional Systems with a delete verification message displayed.

Screen 1.30A - Blank Component Maintenance Parameter Template for the inserted functional system.

From this screen, the user can use normal template editing keys and procedures to enter the name of each component in the functional system from the contractor's design and enter all of the available Component Maintenance Parameters that are included in the design documentation.

<u>User Actions:</u>
Using normal editing procedures, the user will enter all of the components and available maintenance parameters that were obtained from the contractors design documents. See section 3.1.

When the user has finished entering the component names and parameters from the system design, he or she can press the <ESC> key to return screen 1.5 and choose a new functional system to work on or move on to Step 2.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

more

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric

Screen 1.30A - Blank Component Maintenance Parameter Template for the inserted functional system.

Screen 1.31 - Component Maintenance Parameter Template with some information entered.

From this screen, the user can enter or modify information from the system design, press the <ESC> key to return to screen 1.5 and choose a new functional system to work on or move on to step 2.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

more

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
Cylinder Head	repair	63D20	C	1020	miles
Crankshaft	repair	63D20	C	980	miles
Seals, main	replace				

Screen 1.31 **Component Maintenance Parameter Template with some information entered.**

3.5.2 STEP 2 - Match system components and parameters from the contractor's design to baseline estimates from comparable systems.

3.5.2.1 Input

External: The input required for Step 2 is a list of components and estimates of the maintenance parameters that are required by the MMAA (see Step 1) for each component from comparable fielded systems. Ideally, this information will reside in the Baseline Library. However, when a comparable system does not reside in the Library the analyst will need to obtain this information from the following external sources:

- Army Annual Maintenance Manhours Data Base (AMMDB)
- Sample Data Collection Data Base
- Army equipment inventories of fielded systems
- System design specifications for fielded systems
- Technical manuals for maintenance activities
- Subject Matter Experts

Internal: The input for this step that is included within the MMAA will be 1) Component Maintenance Parameter files containing the names of each hardware/software component by functional system created in Step 1. 2) The Baseline Library of Component Maintenance Parameters for fielded systems. 3) MMAA software.

3.5.2.2 Process

The process of identifying baseline estimates of system Component Maintenance Parameters to be entered into the Component Maintenance Parameter Template as government estimates is dependent on the availability of fielded system

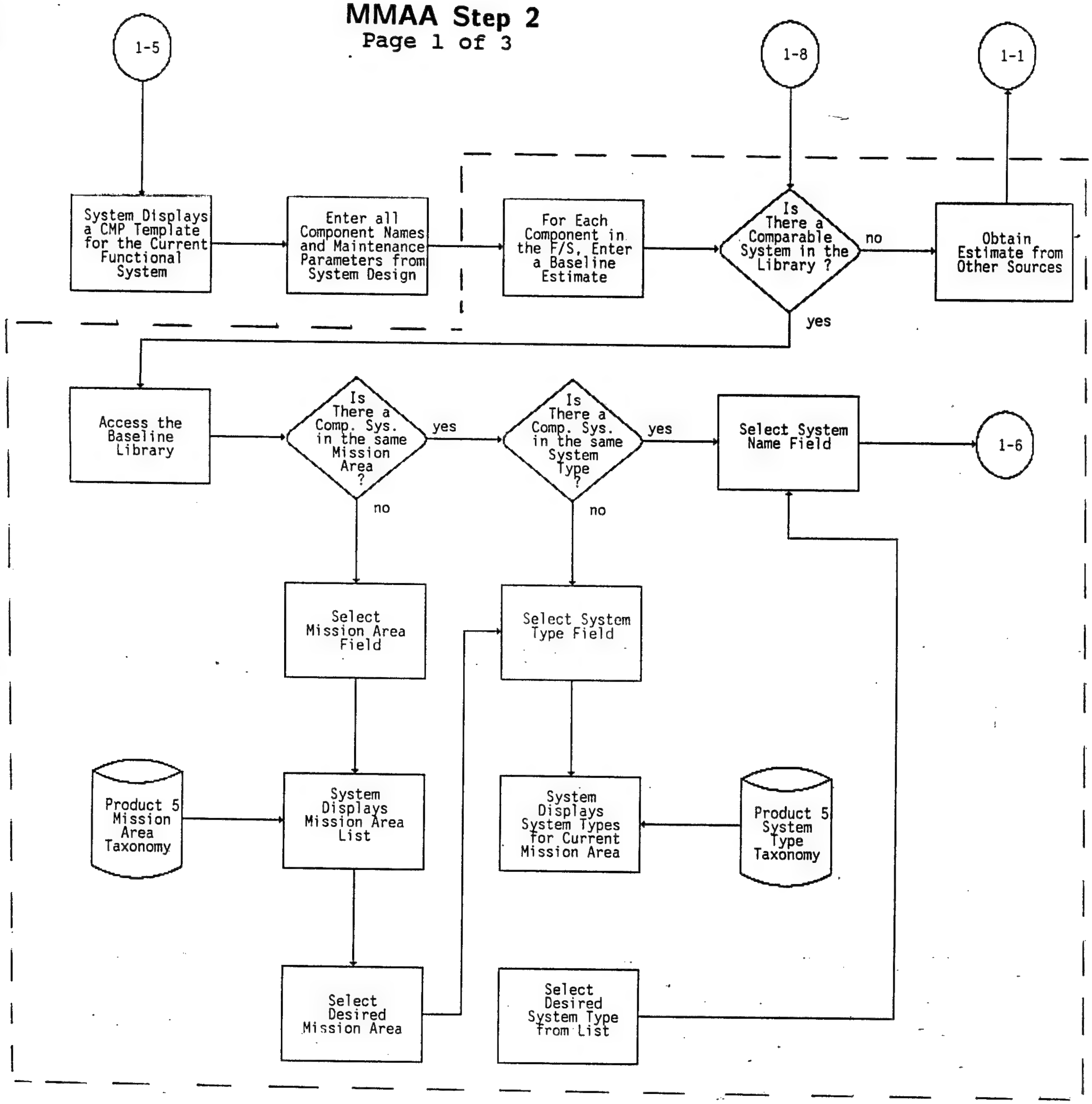
data in the Baseline Library. The user/analyst can enter government estimates directly into the lower portion of each cell of the Component Maintenance Parameter Template using normal editing procedures or copy Component Maintenance Parameters from comparable fielded systems that reside in the Baseline Library.

When the analyst first gains access to the Baseline Library, he or she will need to identify a comparable baseline system down to the functional system level. When the user chooses to view the components and maintenance paremeters for an identified baseline system, a Baseline Library Template, similar to the Component Maintenance Paremeter Template will display. From this template, the user can copy a component and all of its associated maintenance parameters or a block of components and maintenance parameters into a buffer. Then, the user can return to the Component Maintenance Parameter Template in which he or she was working and copy the contents of the buffer into the government estimates portion of the cell or cells for components in the new system. This process is repeated until all of the available baseline estimates have been copied from the Library for all functional systems in the system under evaluation.

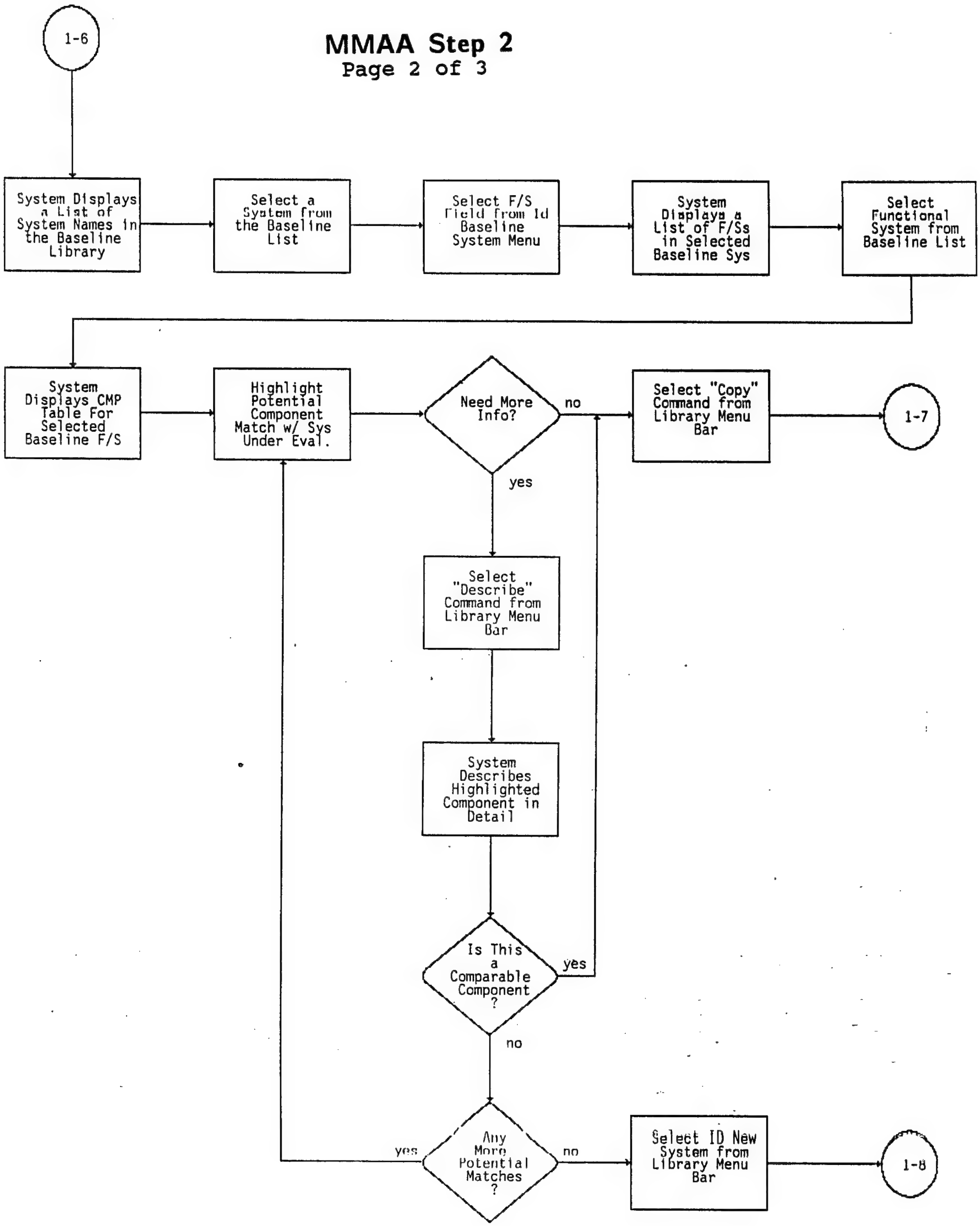
In cases where data from a suitable system does not exist in the Baseline Library, the analyst will need to identify the Component Maintenance Parameters from comparable systems from other sources and enter them directly into the Component Maintenance Parameter Template using the process outlined in Step 1.

The flow diagrams of the process of performing Step 2 are included on the following pages.

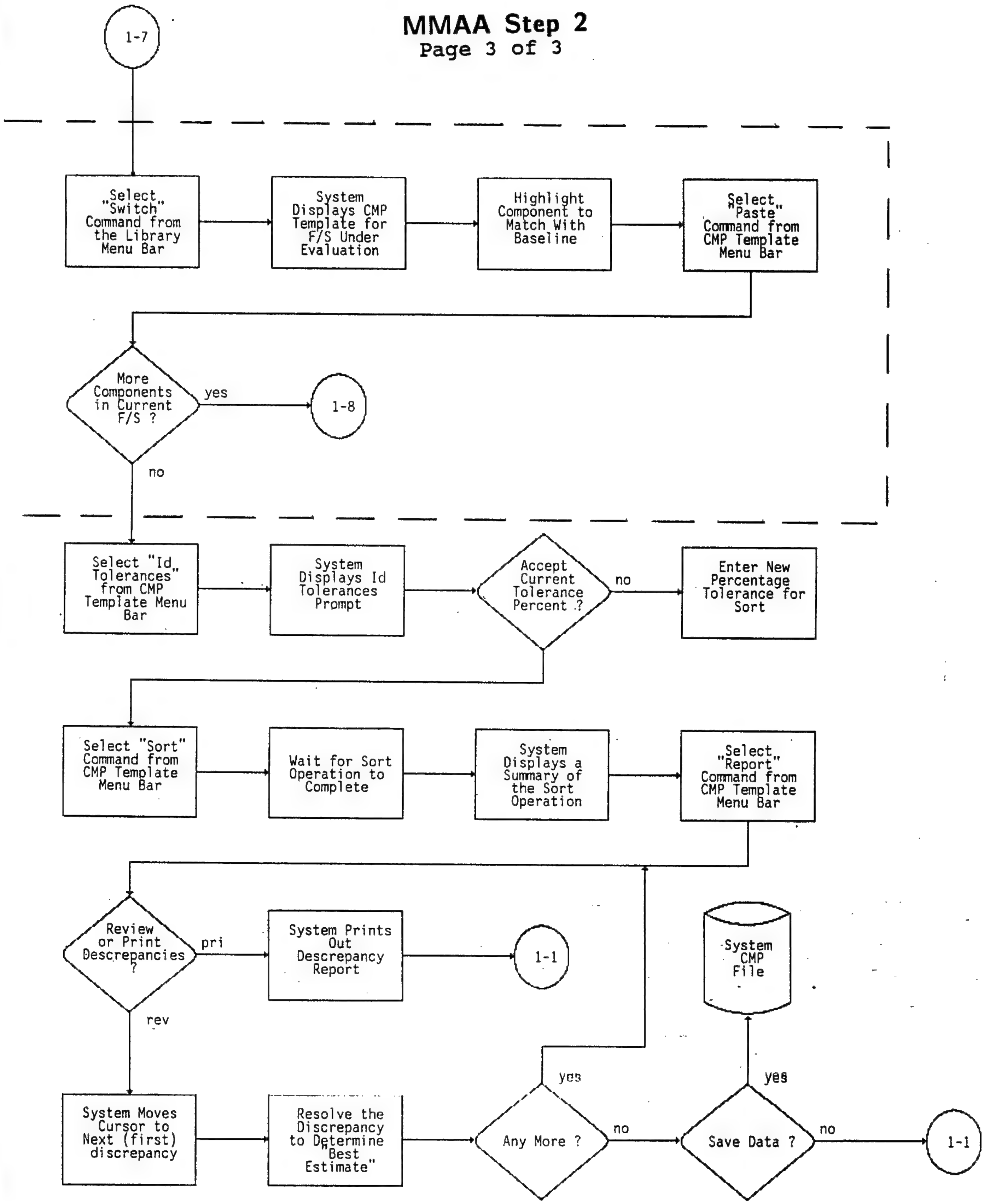
MMAA Step 2


1-5
1-8
1-1
System Displays a CMP Template for the Current Functional System
Enter all Component Names and Maintenance Parameters from System Design
For Each Component in the F/S, Enter a Baseline Estimate
Is There a Comparable System in the Library ?
no
Obtain Estimate from Other Sources
yes
Access the Baseline Library
Is There a Comp. Sys. in the same Mission Area ?
yes
Is There a Comp. Sys. in the same System Type ?
yes
Select System Name Field
1-6
no
no
Select Mission Area Field
Select System Type Field
Product 5 Mission Area Taxonomy
System Displays Mission Area List
System Displays System Types for Current Mission Area
Product 5 System Type Taxonomy
Select Desired Mission Area
Select Desired System Type from List

MMAA Step 2
Page 2 of 3



MMAA Step 2
Page 3 of 3



3.5.2.3 Output

The output of this step will be a set of Component Maintenance Parameter Templates that are stored as records in the Component Maintenance Parameters data file for the current system. Each record will contain a list of the component names, the Component Maintenance Parameters for each component that were available from the system design and a government estimate of Component Maintenance Parameters from comparable fielded systems.

3.5.2.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.31 - Component Maintenance Parameter Template.

Whenever the user has entered one or more components to the Component Maintenance Parameter Template, he or she can gain access to the Baseline Library to search for a comparable system component.

<u>User Actions:</u>

F9 Displays the menu bar of commands that are available from the Component Maintenance Parameter Template. Next screen is 1.36.

<ESC> Returns the user to screen 1.5.

PATH: MDA>MMAA>Component Maintenance Paremeters   MODE: Work

more

System name: UH-60 Black Hawk	Functional System: Engine				
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
Cylinder Head	repair	63D20	C	1020	miles
Crankshaft	repair	63D20	C	980	miles
Seals, main	replace				

Screen 1.31 - Component Maintenance Parameter Template.

Screen 1.36 - Component Maintenance Parameter Template with menu bar displayed.

From this screen, the user can gain access to the Baseline Library, paste one or more components and maintenance parameters copied into the buffer from the Baseline Library, identify tolerances for a sort operation (Step 3), sort the Component Maintenance Parameter Template for discrepancies (Step 3), or report discrepancies found during the most recent sort operation (Step 3).

<u>User Actions:</u>

Access Library - When this command is selected the system will switch the user to the Identify Baseline System menu in the Baseline Library. Next screen 1.37.

Paste - When this command is selected, the system will paste the contents of the copy buffer into the government estimates portion of the Component Maintenance Parameter Template at the current cell cursor location. Next screen is 1.48.

Id Tolerances - When this command is selected the user will be able to change the tolerance value for the next sort operation (Step 3). Next screen is 1.52.

Sort - When this command is selected, the system will begin a sort operation (Step 3). Next screen is 1.55.

Report - When this command is selected, the user will be able to get a report of the results of the most recent sort operation (Step 3). Next screen is 1.58.

<ESC> Returns the user to screen 1.31.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

Access Library Paste Id Tolerances Sort Report

Gain access to Baseline Library to select comparable system components

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
Cylinder Head	repair	63D20	C	1020	miles
Crankshaft	repair				miles
Seals, main	replace				

Screen 1.36 - Component Maintenance Parameter Template with menu bar displayed.

Screen 1.37 - Identify Baseline System menu.

This menu displays the Mission Area, System Type and Functional System name from the current Component Maintenance Parameters Template as default values. The user can change any of these fields or select the System Name field to identify a comparable system.

User Actions:

1. Mission Area - Next screen is 1.39.

2. System Type - A menu of System Types for the identified Mission Area displays. Next screen is 39A??.

3. System Name - A list of System Names that reside in the Baseline Library for the identified System Type displays. Next screen is 1.40. If a System Type has not been identified, an error message displays.

4. Functional System - A list of functional systems for the identified System Name displays. Next screen is 1.42. If a System Name has not been identified, an error message displays.

5. View System Components - A matrix of components and Component Maintenance Parameters from the Baseline Library displays. Next screen is 1.43. If a functional system has not been identified, an error message displays.

PATH: Baseline Library> MODE: Work

IDENTIFY BASELINE SYSTEM	
1.	Mission Area: Aviation
2.	System Type: Utility Helicopters
3.	System Name:
4.	Functional System: Engine
5.	View System Components

Screen 1.37 **Identify Baseline System menu.**

Screen 1.39 - Mission Area List.

From this menu, the user can select a Mission Area to begin the search for a baseline system.

User Actions:

Using normal menu selection procedures the user will select a Mission Area from the list. Next screen is 1.37.

<ESC> Returns the user to screen 1.37.

Input File:

Product 5 Missions by System Type Taxonomy file.

PATH: Baseline Library> MODE: Work

IDENTIFY BASELINE SYSTEM

1. Mission Area: Aviation
2. System Type: Utility H
3. System Name:
4. Functional System: Engi
5. View System Components

MISSION AREA LIST

1. Air Defense
2. Aviation
3. Combat Service Support
4. Close Combat Light
5. Close Combat Heavy
6. Fire Support
7. Cancel

Screen 1.39 - Mission Area List.

Screen 1.39A - List of System Types for the identified Mission Area.

From this screen, the user can select a System Type for the Baseline Library search for a comparable system.

User Actions:
Using normal menu selection procedures, the user can choose a System Type. Next screen is 1.37.

<ESC> Returns the user to screen 1.37 with no change to the System Type field.

Input File:
Product 5 Missions by System Type Taxonomy file.

PATH: Baseline Library> MODE: Work

IDENTIFY BASELINE SYSTEM

1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name:
4. Functional System: Engine
5. View System Components

AVIATION SYSTEM TYPES

1. Attack Helicopters
2. Cargo Helicopters
3. Utility Helicopters
4. Scout Helicopters
5. Other Helicopters
6. Fixed Wing

Screen 1.39A - **List of System Types for the identified Mission Area.**

Screen 1.40 - List System Names that reside in the Baseline Library for the identified System Type.

From this screen, the user can select a System Type to search for comparable components.

<u>User Actions:</u>
Using normal menu selection procedures the user can select a System Name. Next screen is 1.41.

<u>Input File:</u>
Product 5 MMAA Baseline Library.

PATH: Baseline Library>　　MODE: Work

```
IDENTIFY BASELINE SYSTEM

1.  Mission Area:  Aviation
2.  System Type:  Utility Helicopters
3.  System Name:
4.  Functional System: Eng
5.  View System Components
```

```
BASELINE UTILITY HELICOPTERS

1.  UH-1 Iroquois
2.  UH-60 Black Hawk
3.  UH-2C
```

Screen 1.40 - **List System Names that reside in the Baseline Library for the identified System Type.**

Screen 1.41 - Identify Baseline System menu with Mission Area, System Type, System Name, and Functional System identified.

From this screen, the user can choose to view components and maintenance parameters for the identified functional system from the Baseline Library or identify a new comparable system to the functional system level.

User Actions:

1. Mission Area. Next screen is 1.39.

2. System Type - Next screen is 1.39A??.

3. System Name - Next screen is 1.40.

4. Functional System - 1.42.

5. View System Components - The system displays a matrix of components and maintenance parameters for the identified functional system. Next screen is .143.

<ESC> Returns the user to the Component Maintenance Paremeter Template for the current functional system. Next screen is 1.36.

PATH: Baseline Library>   MODE: Work

IDENTIFY BASELINE SYSTEM
1. Mission Area: Aviation
2. System Type: Utility Helicopters
3. System Name: UH-60 Black Hawk
4. Functional System: Engine
5. View System Components

Screen 1.41 - **Identify Baseline System menu with Mission Area, System Type, System Name, and Functional System identified.**

Screen 1.42. - Functional System list for the identified System Name.

From this screen, the user can select a functional system to search for components and maintenance parameters that are comparable to those in the system under evaluation.

<u>User Actions:</u>
Using normal menu selection procedures, the user can select a functional system. Next screen is 1.41.

<ESC> Returns the user to screen 1.41.

<u>Input File:</u>
Product 5 MMAA Baseline Library.

```
PATH: Baseline Library)                                                MODE: Work

        IDENTIFY BASELINE SYSTEM

 1.  Mission Area:   Aviation
 2.  System Type:   Utility Helic   FUNCTIONAL SYSTEM LIST FOR:
 3.  System Name:   UH-60 Black H   UH-60 BLACK HAWK
 4.  Functional System: Engine
 5.  View System Components           1. Hydraulic
                                      2. Electrical
                                      3. Communications
                                      4. Fire Control
                                      5. Engine
                                      6.       .
                                      7.       .
                                      8.       .
                                      9.       .
                                      0.       .
                                        More
```

Screen 1.42. - Functional System list for the identified System Name.

Screen 1.43 - Matrix of components names and maintenance parameters for the selected functional system.

From this screen the user can use normal cursor movement functionality to view each of the components and its associated maintenance parameters in the matrix. When the user is ready to copy one or more components into the buffer, he or she will highlight that component. The cell cursor in the Baseline Library will always highlight a component and all of its maintenance parameters since the copy operation will always copy all of the maintenance parameters for a component. To highlight a block of components, the user will move the cell highlight cursor to the first component in the block and then press the <ENTER> key. This will "anchor" the highlighting. Then the user can use the up or down arrow keys to highlight additional components and their maintenance parameters.

User Actions:
Using the cell highlighting procedures outlined above, the user will highlight cells.

F9 - Will display a menu bar of commands that are available from this matrix. Next screen is 1.44.

<ESC> When a block of components is highlighted, this key will de-highlight all but the first component in the block. When only one component is highlighted, pressing this key will return the user to screen 1.41.

Input File:
Product 5 MMAA Baseline Library.

PATH: Baseline Library MODE: Work

System name: UH-60 Black Hawk	Functional System: Engine					
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric	
Fuel Injection	adjust	63D10	C	107.5	miles	
Cylinder Head	replace	63D10	C	1500	miles	
Crankshaft	repair	63D20	C	1120	miles	
Seals, main	replace	63D10	C	1000	miles	
Master cylinder	repair	63D20	C	2500	miles	
Battery Pack	replace	43D20	C	.750	time	
Rod, connecting	inspect	63D20	P	4500	miles	
Rod, connecting	replace	63D30	C	12500	miles	

Screen 1.43 - Matrix of components names and maintenance

Screen 1.44 - Matrix of components names and maintenance parameters for the selected functional system with menu bar commands displayed.

From this screen, the user can select and initiate any of the displayed commands.

<u>User Action:</u>
Copy - When the copy command is selected, the system will copy all highlighted components and their maintenance parameters into the copy buffer. Any information already in the buffer will be lost. The screen remains the same.

Describe - When this command is selected, the system will display a detailed description of the highlighted component. An example of the screen that will follow is screen 1.45. If a block of components is currently highlighted the system will display an error message telling the user to highlight only one component when selecting the describe command.

Switch - When this command is selected, the system will switch the user back to the current Component Maintenance Parameter Template. Next screen is 1.32.

Id New System - When this command is selected, the system will return the user to the Identify Baseline System menu. Next screen is 1.41.

<ESC> Returns the user to screen 1.43.

PATH: Baseline Library MODE: Work
Copy Describe Switch Id new system
Copy highlighted components and parameters

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric	
Fuel Injection	adjust	63D10	C	107.5	miles	
Cylinder Head	replace	63D10	C	1500	miles	
Crankshaft	repair	63D20	C	1120	miles	
Seals, main	replace	63D10	C	1000	miles	
Master cylinder	repair	63D20	C	2500	miles	
Battery Pack	replace	43D20	C	750	time	
Rod, connecting	inspect	63D20	P	4500	miles	
Rod, connecting	replace	63D30	C	12500	miles	

Screen 1.44 - **Matrix of components names and maintenance parameters for the selected functional system with menu bar commands displayed.**

Screen 1.45 - Detailed description of a component in the Baseline Library.

This is a purely informational screen to help the user decide if this is truly a comparable component to one in the system under evaluation.

User Actions:

The only two user actions that are available from this screen are the following:

<ENTER> Returns the user to screen 1.43.

<ESC> Returns the user to screen 1.43.

Input File:

Product 5 MMAA Baseline Library.

PATH: Baseline Library MODE: Work
Copy Describe Switch Id new system
Present a detailed description of the highlighted component

System name: UH-60 Black Hawk

FUEL INJECTION

Detailed description of the
fuel injection component
including the size, MIL spec #
manufacturer and any other
identifying information that
is applicable and available

Component Name	Maintenance Action				
Fuel Injection	adjust				
Cylinder Head	replace				
Crankshaft	repair				
Seals, main	replace				
Master cylinder	repair				
Battery Pack	replace				
Rod, connecting	inspect				
Rod, connecting	replace	63D30	C	12500	miles

Screen 1.45 - Detailed description of a component in the Baseline Library.

Screen 1.48 - Component Maintenance Parameter Template with baseline maintenance parameters copied from the Baseline Library pasted into the government estimates portion of a cell.

<u>User Actions:</u>

The actions that are available to the user from this screen are the same as those available from screen 1.36.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

Access Library Paste Id Tolerances Sort Report

Retrieve the maintenance parameters for one or more Baseline components

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
Cylinder Head	repair	63D20	C	1020	miles
Crankshaft	repair	63D20	C	980	miles
	repair	63D20	C	1120	miles
Seals, main	replace				

Screen 1.48 - Component Maintenance Parameter Template with baseline maintenance parameters copied from the Baseline Library pasted into the government estimates portion of a cell.

3.5.3 STEP 3 - Identify discrepancies between the government baseline estimates and the contractor's design estimates of Component Maintenance Parameters.

3.5.3.1 Input

<u>External:</u> Analyst judgement on the amount of tolerance he or she will accept for deviations between the baseline data and the contractor's estimates.

<u>Internal:</u> The Component Maintenance Parameter data files containing both baseline data and contractor's estimates of the maintenance parameters that were completed in Step 2.

3.5.3.2 Process

The performance of this step is dependent on the availability of the contractor's design estimates for at least some of the Component Maintenance Parameters. When the contractor's design dosen't include any estimates of Component Maintenance Parameters required by the MMAA, the analyst will use the baseline government estimates as the only input to the simulation model. When this is the case, the analyst can skip this step.

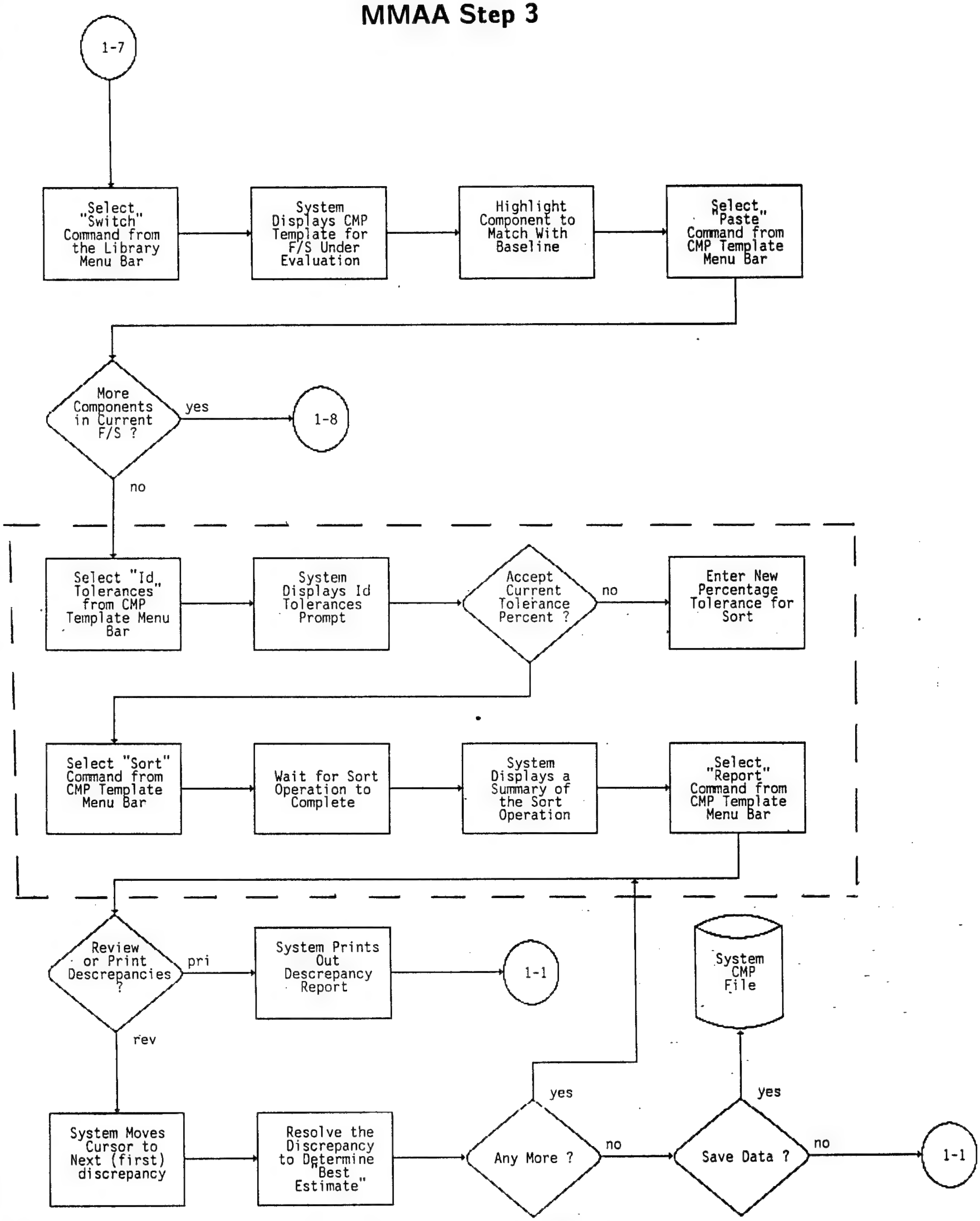
When the a Component Maintenance Parameters Template contains all of the baseline and contractor estimates that are available, the analyst can have the system sort through each pair of estimates for each component in the functional system to identify discrepancies. However, before sorting the Template, the analyst may want to change the tolerance value that defines a discrepancy. The default tolerance value is 10%. This means that when the Template is sorted, any difference between the contractor and government

estimate that is within 10 persent is <u>not</u> considered a difference.

When the system has sorted a Component Maintenance Paremeter Template a summary of the sort operation is displayed to the user. In addition, a list of all identified discrepancies is stored in a data file. The user can then have the system either print the list of discrepancies or present them one by one on the screen for the analyst to review and resolve (Step).

The flow diagram of the process of performing Step 3 are included on the following page.

MMAA Step 3


1-7
Select "Switch" Command from the Library Menu Bar
System Displays CMP Template for F/S Under Evaluation
Highlight Component to Match With Baseline
Select "Paste" Command from CMP Template Menu Bar
More Components in Current F/S ?
yes
1-8
no
Select "Id Tolerances" from CMP Template Menu Bar
System Displays Id Tolerances Prompt
Accept Current Tolerance Percent ?
no
Enter New Percentage Tolerance for Sort
Select "Sort" Command from CMP Template Menu Bar
Wait for Sort Operation to Complete
System Displays a Summary of the Sort Operation
Select "Report" Command from CMP Template Menu Bar
Review or Print Descrepancies ?
pri
System Prints Out Descrepancy Report
1-1
System CMP File
rev
System Moves Cursor to Next (first) discrepancy
Resolve the Discrepancy to Determine "Best Estimate"
Any More ?
yes
no
Save Data ?
yes
no
1-1

3.5.3.3 Output

The results of the sort operation will store a list of the differences or discrepancies between government and contractor estimates of Component Maintenance Parameters for each functional system of the system under evaluation. Any sort operation will only affect the discrepancy list for that functional system. However, each sort of the same functional system will replace the contents of the discrepancy file for that functional system.

3.5.3.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.52 - Component Maintenance Parameters Template with Id Tolerances selected on the menu bar and the "Current Percentage Difference Tolerance" prompt displayed.

A flashing cursor is displayed below the first character of the current tolerance value.

User Action:
Using normal editing keys and procedures, the user can change the tolerance value. The user will terminate input by pressing the <ENTER> key. Next screen is 1.36. If the tolerance value entered is not within the allowable range, an error message will display explaining the tolerance range.

<ESC> Returns the user to screen 1.36 without changing the current tolerance value.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

Access Library Paste Id Tolerances Sort Report

Identify percentage differences in that will be ignored during sort operation

System name: UH-60 Black Hawk Functional System: Engine

Component Name	M				erational it Metric	
Fuel Injection					les	
Cylinder Head	repair	63D20	C	1020	miles	
Crankshaft	repair	63D20	C	980	miles	
Seals, main	replace					

Current Percentage Difference Tolerance: 10

modify accept

Screen 1.52 - Component Maintenance Parameters Template with Id Tolerances selected on the menu bar and the "Current Percentage Difference Tolerance" prompt displayed.

Screen 1.55 - Component Maintenance Parameter Template with the "Sort operation in progress" message displayed.

At this point, the user must simply wait for the sort operation to complete.

<u>User Actions:</u>

None. Next screen is 1.56.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Wait
Access Library Paste Id Tolerances Sort Report
Compare contract design and govt. estimates to identify discrepancies

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust			107.5	miles
Cylinder Head	repair			1020	miles
Crankshaft	repair	63D20	C	980	miles
Seals, main	replace				

Sort operation
in progress.

Screen 1.55 - Component Maintenance Parameter Template with the "Sort operation in progress" message displayed.

Screen 1.56 - Sort operation summary screen.

This screen is informational the only accepted response is for the user to press the <ENTER> key. Next screen is 1.36.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work
Access Library Paste Id Tolerances Sort Report
Compare contract design and govt. estimates to identify discrepancies

System name: UH-60 Black Hawk Functional System: Engine

Componen Name					rational t Metric	
Fuel Injec					es	
Cylinder H					es	
Crankshaft					es	
Seals, main	replace					

Sort operation complete.

29 maintenance actions had no baseline estimate.
15 maintenance actions had no design estimate.

37 maintenance actions had discrepancies that
were outside defined tolerances.

Press <ENTER> to continue.

Screen 1.56 - Sort operation summary screen.

Screen 1.58 - Component Maintenance Parameters Template with report options displayed on the menu bar.

From this screen, the user can choose to print out a list of the identified discrepancies from the most recent sort operation or review each discrepancy one by one on-line.

User Actions:

Review - When this command is selected, the cell cursor will move to the cell in the template where the first discrepancy exists. When the user presses the <ENTER> key the cursor will move to the cell with the next identified discrepancy. An example of the next screen is 1.62.

Print - When this command is selected, the system begins to print the discrepancy list for the most recent sort operation for this functional system. Next screen is 1.66.

<ESC> Returns the system to screen 1.36.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work
Review Print out
Proceed to next unresolved discrepancy in the template

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric	
Fuel Injection	adjust	63D10	C	107.5	miles	
Cylinder Head	repair	63D20	C	1020	miles	
Crankshaft	repair	63D20	C	980	miles	
Seals, main	replace					

Screen 1.58 - **Component Maintenance Parameters Template with report options displayed on the menu bar.**

Screen 1.62 - Component Maintenance Parameter Template with a discrepancy cell highlighted.

From this screen, the user can either move on to Step 4 and resolve the discrepancy or review the next discrepancy.

<u>User Actions:</u>

<ENTER> - If a discrepancy still exists between the government and contractor estimates for this cell, screen 1.63 displays (Step 4). If a discrepancy no longer exists, pressing the <ENTER> key moves the cell cursor to the next identified discrepancy.

<ESC> Returns the user to screen 1.58.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

System name: UH-60 Black Hawk	Functional System: Engine					
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric	
Fuel Injection	adjust	63D10	C	107.5	miles	
	adjust	63D20				
Cylinder Head	repair	63D20	C	1020	miles	
Crankshaft	repair	63D20	C	980	miles	
Seals, main	replace					

Screen 1.62 - Component Maintenance Parameter Template with a discrepancy cell highlighted.

Screen 1.66 - Component Maintenance Parameter Template with report options displayed on the menu bar and the "PRINTING" message displayed.

From this screen, the user must wait for the printing operation to complete.

<u>User Actions:</u>

None. Next screen is 1.66A.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Wait
Review Print out
Print out a list of discrepancies by component

System name: UH-60 Black Hawk	Functional System: Engine				
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
	adjust	PRINTING			
Cylinder Head	repair		C	1020	miles
Crankshaft	repair	63D20	C	980	miles
Seals, main	replace				

Screen 1.66 - **Component Maintenance Parameter Template with report options displayed on the menu bar and the "PRINTING" message displayed.**

Screen 1.66A - Component Maintenance Parameter Template with report options displayed on the menu bar and the "PRINTING COMPLETE" message displayed.

User Actions:

The only accepted user action is pressing the <ENTER> key. Next screen is 1.58.

PATH: MDA>MMAA>Component Maintenance Paremeters   MODE: Work

Review   Print out

Print out a list of discrepancies by component

System name: UH-60 Black Hawk	Functional System: Engine				
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
	adjust				
Cylinder Head	repair			1020	miles
Crankshaft	repair	63D20	C	980	miles
Seals, main	replace				

PRINTING COMPLETED

Press <ENTER> to continue

Screen 1.66A - Component Maintenance Parameter Template with report options displayed on the menu bar and the "PRINTING COMPLETE" message displayed.

3.5.4 STEP 4 - Resolve the discrupancies between the government baseline estimates and the contractor's design estimates of the Component Maintenance Parameters.

3.5.4.1 Input

<u>External:</u> The external inputs for resolving Component Maintenance Parameter discrepancies are the following:

- Maintenance Subject Matter Experts
- System design documents including the maintenance task analysis
- System design engineers
- Analyst judgement

<u>Internal:</u> The Component Maintenance Parameter discrepancy data file created in Step 3.

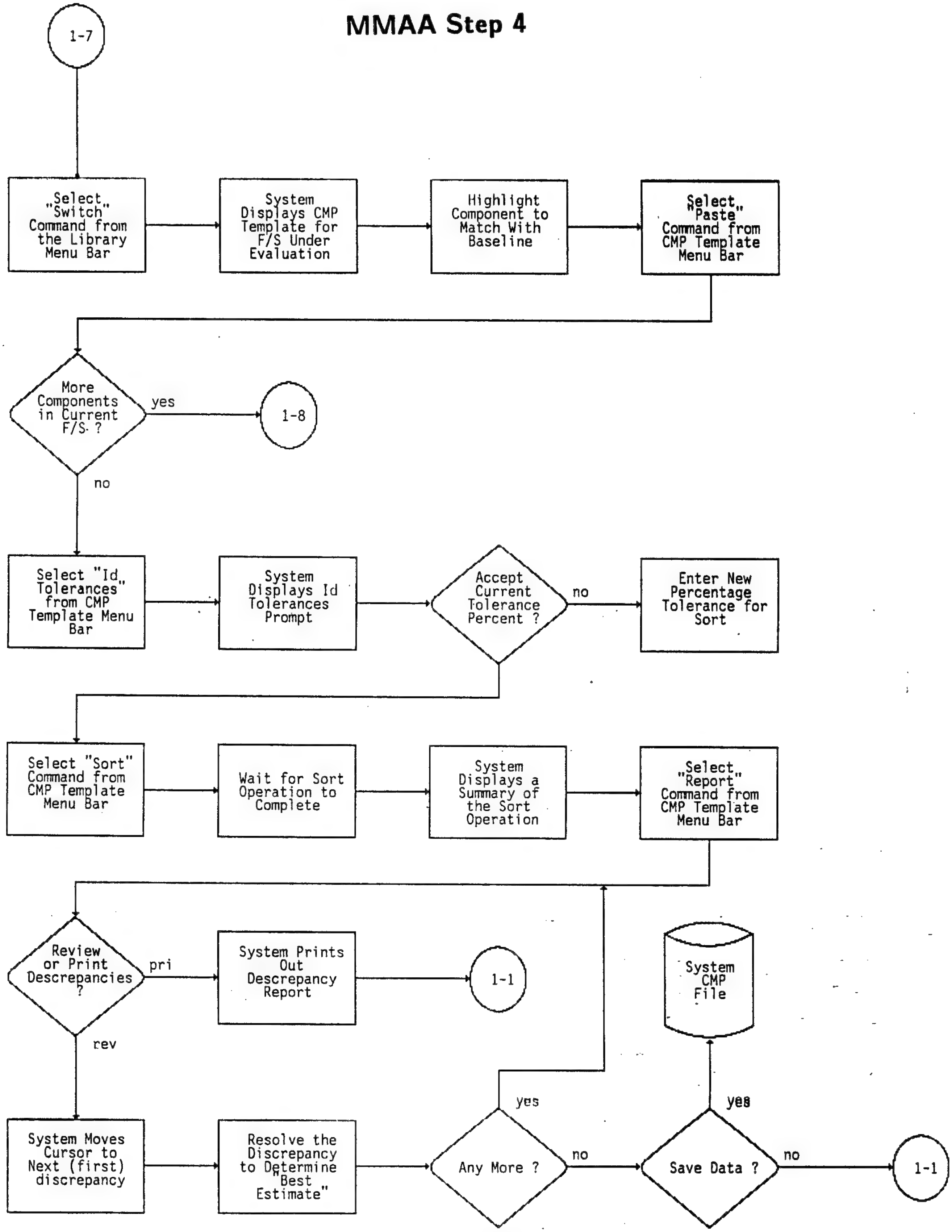
3.5.4.2 Process

When the MMAA has identified and stored discrepancies between government and contractor estimates of Component Maintenance Parameters for a particular Functional System, the analyst can review each discrepancy one by one from the Component Maintenance Parameter Template. The MMAA will move the cell cursor to the next discrepancy. At this time, the user of the MMAA can either resolve each discrepancy by changing the baseline estimate to one that he or she believes is a more realistic estmate based on further analysis or leave the baseline estimate as it is. When the analyst is finished editing a cell and presses the <ENTER> key to move on to the next discrepancy, the MMAA checks to see if there is still a discrepancy between the two

estimates. If there is still a discrepancy, the system will display a message to the user asking if he or she wants to remove this set of estimates from the discrepancy list. When the Maintenance Requirements Simulation model is executed (Step 6), the user will be able to choose to use either the government or contractor's estimates of Component Maintenance Parameters.

The flow diagrams of the process of performing Step 4 are included on the following page.

MMAA Step 4


1-7
Select "Switch" Command from the Library Menu Bar
System Displays CMP Template for F/S Under Evaluation
Highlight Component to Match With Baseline
Select "Paste" Command from CMP Template Menu Bar
More Components in Current F/S ?
yes
1-8
no
Select "Id Tolerances" from CMP Template Menu Bar
System Displays Id Tolerances Prompt
Accept Current Tolerance Percent ?
no
Enter New Percentage Tolerance for Sort
Select "Sort" Command from CMP Template Menu Bar
Wait for Sort Operation to Complete
System Displays a Summary of the Sort Operation
Select "Report" Command from CMP Template Menu Bar
Review or Print Descrepancies ?
pri
System Prints Out Descrepancy Report
1-1
System CMP File
rev
yes
yes
System Moves Cursor to Next (first) discrepancy
Resolve the Discrepancy to Determine "Best Estimate"
Any More ?
no
Save Data ?
no
1-1

3.5.4.3 Output

The output of the step is the Component Maintenance Parameter file that contains the contractor's estimates of maintenance parameters for each component and the government's best estimate of those same maintenance parameters.

3.5.4.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.57 - Component Maintenance Parameter Template with menu bar commands displayed.

From this screen, the user can select the "Report" command to begin resolving discrepancies identified during the most recent "Sort" operation or choose any of the other menu bar commands.

<u>User Actions:</u>

Access Library - Next screen is 1.41.

Paste - Next screen is 1.48.

Id Tolerances - Next screen is 1.52.

Sort - Next screen is 1.55.

Report - Next screen is 1.58

<ESC> Returns the user to screen 1.31.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work
Access Library Paste Id Tolerances Sort Report
Report the discrepancies between contractor and government estimates

System name: UH-60 Black Hawk	Functional System: Engine				
Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
Cylinder Head	repair	63D20	C	1020	miles
Crankshaft	repair				miles
Seals, main	replace				

Screen 1.57 - Component Maintenance Parameter Template with menu bar commands displayed.

Screen 1.63 - Component Maintenance Parameter Template with discrepancy message displayed.

From this screen, the user can choose to remove this discrepancy from the list or leave it on the list and move to the next discrepancy.

<u>User Actions:</u>

Y - Remove the current discrepancy from the list and move the cell cursor to the next discrepancy. Next screen is 1.62.

N - Move the cell cursor to the next discrepancy in the list but don't remove this discrepancy from the list.

<ESC> Returns the user to screen 1.62 without moving on to the next discrepancy.

PATH: MDA>MMAA>Component Maintenance Paremeters MODE: Work

System name: UH-60 Black Hawk Functional System: Engine

Component Name	Maintenance Action	MOS/Skill	Type (P/C)	MOUBF	Operational Unit Metric
Fuel Injection	adjust	63D10	C	107.5	miles
	adjust	63D20			
Cylinder Head	repair			1020	miles
Crankshaft	repair			980	miles
Seals, main	replace				

Discrepancy still exists.
Ok to remove from list ?

Enter y or n to continue.

Screen 1.63 **Component Maintenance Parameter Template with discrepancy message displayed.**

3.5.5 STEP 5 - Identify/develop parameters for each maintenance scenario to be analyzed in terms of maintenance manhour and headcount requirements, system reliability, and system availability.

3.5.5.1 Input

External: Mission requirements obtained from the System Performance Requirements Estimation Aid (SPREA) in Product 1. Data on mission requirements obtained from the Operational Mode Summary/Mission Profile, MAA/MADP results, LSA, and the Army's Sample Data Collection system. Specific external input data will include:

- mission name
- number of missions per day
- mean mission duration
- deviation (+ -) from mission mean time
- mean time between missions
- deviation (+ -) from mean time between missions
- operational units per mission for each hardware/software component in the system.

Internal: The internal input for this step will be the MMAA software, the Component Maintenance Parameters data file, the Mission/Condition Set file, and the judgement of the Army analyst. The specific information that the analyst will suppy includes:

- A scenario file name
- The time span for the simulation

- o Judgement on selecting the other (external) mission parameters.

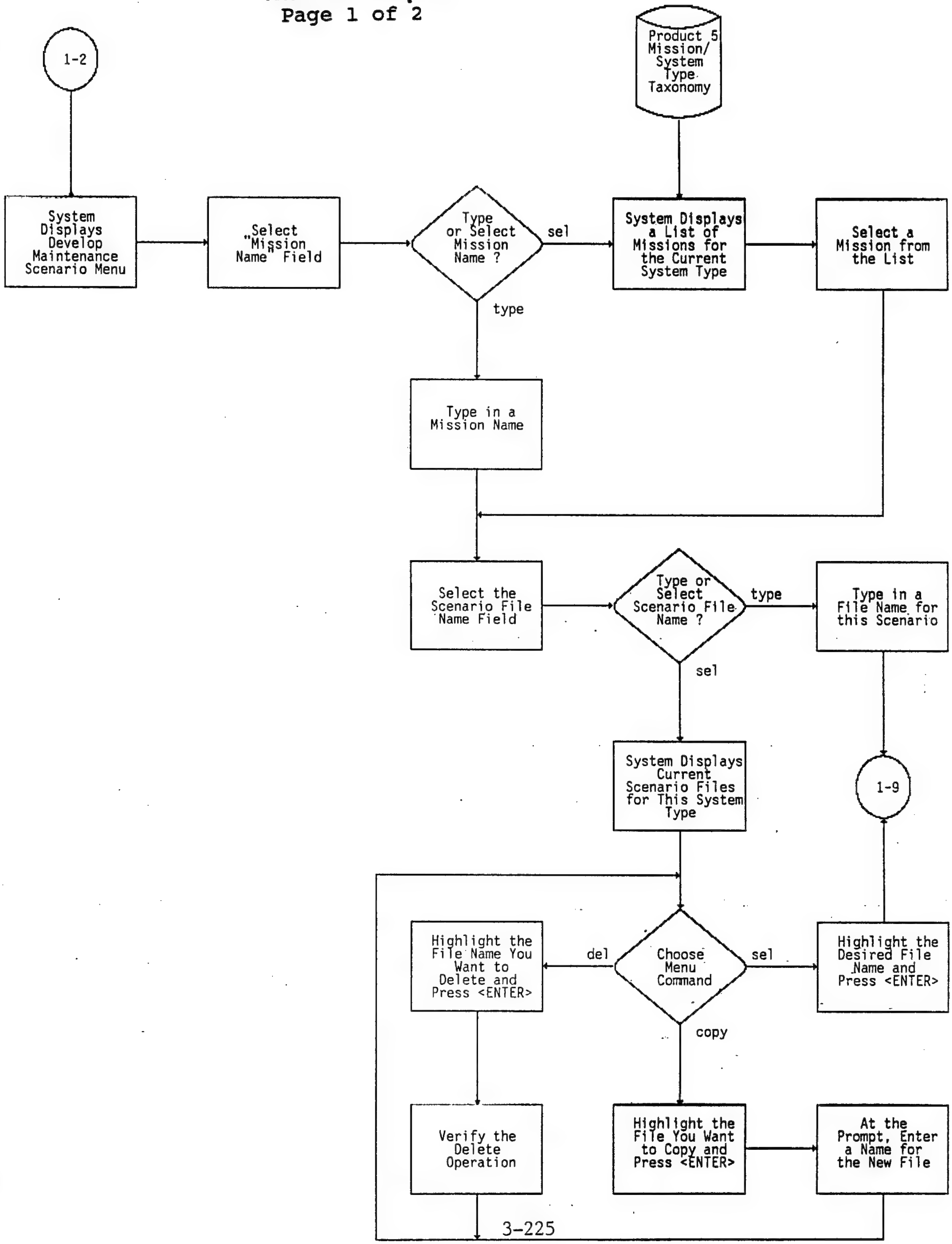
3.5.5.2 Process

When the analyst has modified the baseline estimates of Component Maintenance Parameters to reflect the best available estimates, he or she will need to define a maintenance scenario for the maintenance requirements simulation. The analyst will create a maintenance scenario to be used by the Maintenance Requirements Simulation model by entering information into fields of the Develop Maintenance Scenario menu. When the analyst selects "Develop component operational units per mission" from the Develop Maintenance Scenario menu, a second menu will display a list of the functional currently saved for the system under evaluation. When a functional system is selected, the MMAA will display an Operational Units Per Mission Template showing the names of each component in the selected Functional System and the operational unit metric for each component. This information will be obtained from the Component Maintenance Parameters data file. The Operational Units Per Mission Template will use the same editing functionality as the Component Maintenance Parameters Template. The analyst will use the editing and keystroke procedures to enter the average number of operational units per mission for each component.

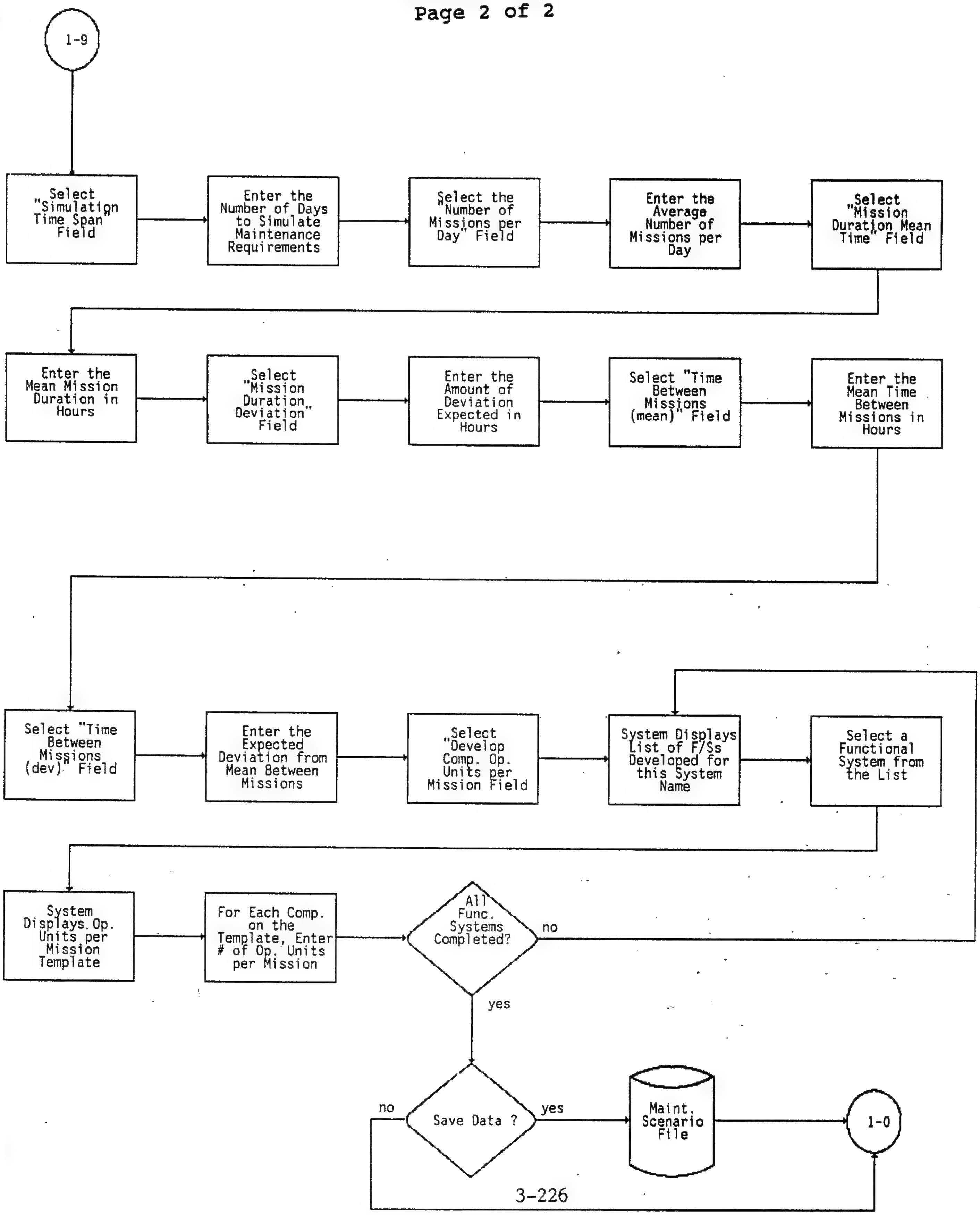
The flow diagrams of the process of performing Step 5 are included on the following pages.

MMAA Step 5

Page 1 of 2



MMAA Step 5
Page 2 of 2



3.5.5.3 Output

The output of this step is a Maintenance Scenario Paramaeters data file for each type of mission required of the system design that is being evaluated. Each scenario data file will be used as input for an execution of the Maintenance Requirements Simulation model.

3.5.5.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.68 - Develop Maintenance Scenario menu.

The mission name field of the Develop Maintenance Scenario menu contains the mission name that appears in the Mission/Condition Set file for this evaluation. From this menu, the user can select any of the menu options in any order. However, the user must enter the "Scenario file name:" before attempting to save the maintenance scenario data. All of the fields on the Develop Maintenance Scenario menu must be completed before the Maintenance Requirements Simulation model can be executed.

User Actions:

1. Mission name: - When this option is selected the user is given the opportunity to either "type-in" or "select" a new mission name. Next screen is 1.69.

2. Scenario file name: - Lets the user choose to type in a new scenario file name or select an existing scanario file to modify. Next screen is 1.70.

3. Simulation time span: - Displays a flashing cursor in the field so that the analyst can enter a number of days to simulate the maintenance requriements. Next screen is 1.72.

4. Number of missions per day: - Displays a flashing cursor in the field and waits for analyst input. Next screen is 1.73.

5. Mission duration mean time: - Displays a flashing cursor in the field and waits for analyst input. Next screen is 1.74.

6. Mission duration deviation (+ -): - Displays a flashing cursor in the field and waits for analyst input. Next screen is 1.75.

7. Time between missions: - Displays a flashing cursor in the field and waits for analyst input. Next screen is 1.76.

8. Time between missions (+ - dev): - Displays a flashing cursor in the field and waits for analyst input. Next screen is 1.77.

9. Develop component operational units per mission - Displays a list of the Functional Systems currently developed for this system. Next screen is 1.78.

<ESC> Returns the user to screen 1.1. If the user has changed any information in any field of the Develop Maintenance Scenario menu since the last time the file was saved, a warning message will display.

Output Files:

All maintenance scenario information will be written to the Scenario file name shown on the Develop Maintenance Scenario menu. If the Scenario file name field is blank, an error message will prompt the user to enter a valid file name.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: 3. Simulation time span (days): 4. Number of missions per day: 5. Mission duration mean time (hours): 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission

Screen 1.68 - Develop Maintenance Scenario menu.

Screen 1.69 - Develop Maintenance Scenario menu with Mission name field highlighted and the "type-in" and "select" commands displayed.

From this screen, the user can choose to type-in a new Mission name or to select a Mission name from a list of missions for the current System Type.

<u>User Actions:</u>

type-in — Displays a flashing cursor in the Mission name field. Next screen is 69B??.

select — Displays a list of missions for the current System Type for the user to choose from. Next screen is 69A??.

<ESC> — Returns the user to screen 1.68.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINTENANCE SCENARIO

1. Mission name: Transport Combat Troops
2. Scenario file name:
3. Simulation time span (days):
4. Number of missions per day:
5. Mission duration mean time (hours):
6. Mission duration deviation (+ -):
7. Time between missions (mean):
8. Time between missions (+ - dev):

9. Develop component operational units per mission

          type-in          select
```

Screen 1.69 - Develop Maintenance Scenario menu with Mission name field highlighted and the "type-in" and "select" commands displayed.

Screen 1.69B - Develop Maintenance Scenario menu with a flashing cursor displayed in the Mission name field.

From this screen, the user can type-in a new mission name for this scenario.

<u>User Actions:</u>
Using normal editing keys and procedures, the user will enter a mission name. Input will be terminated by pressing the <ENTER> key. Next screen is 1.68.

<ESC> Returns the user to screen 1.69.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO	
1. Mission name: _ 2. Scenario file name: 3. Simulation time span (days): 4. Number of missions per day: 5. Mission duration mean time (hours): 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission	
type-in	select

Screen 1.69B - Develop Maintenance Scenario menu with a flashing cursor displayed in the Mission name field.

Screen 1.69A - List of Missions for the current System Type.

From this screen, the user can select a mission name for this scenario.

User Actions:
Using normal menu selection procedures, the user will select a mission name. Next screen is 1.68.

<ESC> Returns the user to screen 1.69.

Input Files:
Product 5 Missions by System Type Taxonomy file.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINT
                              UTILITY HELICOPTER MISSIONS

1. Mission name:              1. Transport Combat Troops
2. Scenario file name:        2. Transport Logistical Supplies
3. Simulation time span       3. Evacuate Casualties
4. Number of missions pe      5.     .
5. Mission duration mean      6.     .
6. Mission duration devi      7.     .
7. Time between missions
8. Time between missions (+ - dev):

9. Develop component operational units per mission

            type-in               select
```

Screen 1.69A - List of Missions for the current System Type.

Screen 1.70 - Develop Maintenance Scenario menu with "Scenario file name:" highlighted and the "type-in" and "select" commands displayed.

From this screen, the user can choose to either type-in a new file name for this scenario or select an already existing scenario file to modify.

<u>User Actions:</u>

type-in   A flashing cursor displays in the "Scenario file name" field. Next screen is 1.70A??.

select   A list of Scenario files that have been saved for the identified System Type displays. Next screen is 1.71.

<ESC>   Returns the user to screen 1.68.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: 3. Simulation time span (days): 4. Number of missions per day: 5. Mission duration mean time (hours): 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission
type-in select

Screen 1.70 - **Develop Maintenance Scenario menu with "Scenario file name:" highlighted and the "type-in" and "select" commands displayed.**

Screen 1.70A - Develop Maintenance Scenario menu with flashing cursor displayed in the "Scenario file name" field.

From this screen, the user can type-in a new Maintenance Scenario file name for this scenario.

User Action:
Using normal editing keys and procedures, the user will enter a scenario file name. Input will be terminated by pressing the <ENTER> key. Next screen is 1.68.

<ESC> Returns the user to screen 1.70.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: _ 3. Simulation time span (days): 4. Number of missions per day: 5. Mission duration mean time (hours): 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission
type-in select

Screen 1.70A - Develop Maintenance Scenario menu with flashing cursor displayed in the "Scenario file name" field.

Screen 1.71 - List of Maintenance Scenario files for the current System Type.

From this screen, the user can select, copy, or delete a scenario file.

User Actions:

select — The MMAA software reads the highlighted scenario file and displays the field parameters on the Develop Maintenance Parameters menu. Next screen is 1.72.

copy — When the copy command is chosen the user can make an exact copy of an existing Maintenance Scenario file. The system displays a flashing cursor in a blank field directly below the highlighted file name. Next screen is 1.71A.

delete — When the delete command is chosen, the user can delete the highlighted Maintenance Scenario file from the list. The system displays a delete verification message before actually deleting the file. Next screen is 1.71B.

<ESC> — Returns the user to screen 1.70.

Input Files:

Maintenance Scenario files for the current System Type.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINTENANCE SCENARIO

1. Mission name: Transport Combat Troo
2. Scenario file name:
3. Simulation time span (days):
4. Number of missions per day:
5. Mission duration mean time (hours):
6. Mission duration deviation (+ -):
7. Time between missions (mean):
8. Time between missions (+ - dev):

9. Develop component operational units

        type-in          select
```

```
SCENARIO FILES FOR:
UTILITY HELICOPTER

    1. TRANS01
    2. TRANS02
    3. RECON01

select   copy   delete
```

Screen 1.71 - **List of Maintenance Scenario files for the current System Type.**

Screen 1.71A - List of Maintenance Scenario files with a flashing cursor displayed in a blank field directly below the file to be copied.

User Actions:

The system will wait for the user to enter a string of allowable characters to be used as the name of the new copy of the highlighted file. The user will terminate the string by pressing the <ENTER> key. The file name must begin with an alpha character and can contain up to eight alpha, numeric, underscore, and hyphen characters. All characters beyond the first eight will be truncated. If the file name entered contains any characters that are not allowed, a tone will sound and an error message will display. Next screen is 1.71.

<ESC> Returns the user to screen 1.71.

Input Files:

Maintenance Scenario files for the current System Type.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINTENANCE SCENARIO

1. Mission name: Transport Combat Troo
2. Scenario file name:
3. Simulation time span (days):
4. Number of missions per day:
5. Mission duration mean time (hours):
6. Mission duration deviation (+ -):
7. Time between missions (mean):
8. Time between missions (+ - dev):

9. Develop component operational units

type-in          select
```

```
SCENARIO FILES FOR:
UTILITY HELICOPTER

1. TRANS01
2.
3. TRANS02
4. RECON01

select   copy   delete
```

Screen 1.71A - List of Maintenance Scenario files with a flashing cursor displayed in a blank field directly below the file to be copied.

Screen 1.71B - Verification message for deleting a scenario file.

To avoid accidental deletion of a scenario file, the delete operation must be verified by the user.

User Actions:

Y The system deletes the highlighted file name on the list of scenario files. Next screen is 1.71.

N The delete command is cancelled. Returns the user to screen 1.71 without performing the delete operation.

<ESC> Returns the user to screen 1.71 without performing the delete operation. Pressing the <ESC> key is functionally the same as pressing "N".

Input Files:

Maintenance Scenario files for the current System Type.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINTENANCE SCENARIO

                                            SCENARIO FILES FOR:
1. Mission name: Transport Combat Troo      UTILITY HELICOPTER
2. Scenari
3. Simulat
4. Number   OK to Delete Scenario file ?    1. TRANS01
5. Mission                                  2. NEWFILE
6. Mission            Y or N ?              3. TRANS02
7. Time be                                  4. RECON01
8. Time between missions (+ - dev):
                                            select   copy   delete
9. Develop component operational units

            type-in            select
```

Screen 1.71B - Verification message for deleting a scenario file.

Screen 1.72 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Simulation time span" field.

From this screen, the user can enter the number of days to simulate maintenance requirements.

User Actions:

The user will use numeric keys to enter the number of days for the simulation. Next screen is 1.68 with the number of days displayed.

<ESC> Returns the user to screen 1.68 without changing the simulation time span.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops
2. Scenario file name: TRANS01
3. Simulation time span (days): _
4. Number of missions per day:
5. Mission duration mean time (hours):
6. Mission duration deviation (+ -):
7. Time between missions (mean):
8. Time between missions (+ - dev):
9. Develop component operational units per mission

Screen 1.72 - **Develop Maintenance Scenario file with a flashing cursor displayed in the "Simulation time span" field.**

Screen 1.73 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Number of missions per day" field.

From this screen, the user can enter the expected number of missions per day in order to simulate maintenance requirements.

<u>User Actions:</u>

The user will use numeric keys to enter the number of missions per day for the simulation. Next screen is 1.68 with the number of missions per day displayed.

<ESC> Returns the user to screen 1.68 without changing the number of missions per day field.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: TRANS01 3. Simulation time span (days): 365 4. Number of missions per day: _ 5. Mission duration mean time (hours): 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission

Screen 1.73 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Number of missions per day" field.

Screen 1.74 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Mission duration mean time" field.

From this screen, the user can enter the mean duration of one of the identified a missions.

User Actions:

The user will use numeric keys to enter the Mission duration mean time. Next screen is 1.68 with the mission duration mean time displayed.

<ESC> Returns the user to screen 1.68 without changing the mission duration mean time.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: TRANS01 3. Simulation time span (days): 365 4. Number of missions per day: 6 5. Mission duration mean time (hours): _ 6. Mission duration deviation (+ -): 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission

Screen 1.74 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Mission duration mean time" field.

Screen 1.75 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Mission duration deviation" field.

From this screen, the user can enter the expected amount of deviation from the mean for mission length.

<u>User Actions:</u>
The user will use numeric keys to enter the deviation amount. Next screen is 1.68 with the mission duration deviation displayed.

<ESC> Returns the user to screen 1.68 without changing the mission duration deviation.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: TRANS01 3. Simulation time span (days): 365 4. Number of missions per day: 6 5. Mission duration mean time (hours): 2 6. Mission duration deviation (+ -): _ 7. Time between missions (mean): 8. Time between missions (+ - dev): 9. Develop component operational units per mission

Screen 1.75 - **Develop Maintenance Scenario file with a flashing cursor displayed in the "Mission duration deviation" field.**

Screen 1.76 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Time between missions (mean)" field.

From this screen, the user can enter the mean number of hours between missions.

User Actions:

The user will use numeric keys to enter the mean number of hours between missions for the simulation. Next screen is 1.68 with the mean number of hours between missions displayed.

<ESC> Returns the user to screen 1.68 without changing the mean number of hours between missions.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

```
DEVELOP MAINTENANCE SCENARIO

1. Mission name: Transport Combat Troops
2. Scenario file name: TRANS01
3. Simulation time span (days): 365
4. Number of missions per day: 6
5. Mission duration mean time (hours): 2
6. Mission duration deviation (+ -): .5
7. Time between missions (mean): _
8. Time between missions (+ - dev):

9. Develop component operational units per mission
```

Screen 1.76 - **Develop Maintenance Scenario file with a flashing cursor displayed in the "Time between missions (mean)" field.**

Screen 1.77 - Develop Maintenance Scenario file with a flashing cursor displayed in the "Time between missions (+ - dev)" field.

From this screen, the user can enter the expected + or - deviation from the mean time between missions.

<u>User Actions:</u>
The user will use numeric keys to enter the time between missions deviation the simulation. Next screen is 1.68 with the + - deviation of mean time between missions displayed.

<ESC> Returns the user to screen 1.68 without changing the deviation of time between missions.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

DEVELOP MAINTENANCE SCENARIO
1. Mission name: Transport Combat Troops 2. Scenario file name: TRANS01 3. Simulation time span (days): 365 4. Number of missions per day: 6 5. Mission duration mean time (hours): 2 6. Mission duration deviation (+ -): .5 7. Time between missions (mean): 2 8. Time between missions (+ - dev): _ 9. Develop component operational units per mission

Screen 1.77 - **Develop Maintenance Scenario file with a flashing cursor displayed in the "Time between missions (+ - dev)" field.**

Screen 1.78 - Current List of Functional Systems for the system under eveluation.

From this screen, the user can select a Functional System for which he or she will enter the number of operational units that will be attributed to each component for each mission.

<u>User Actions:</u>
Using normal menu selection procedures, the user will select a functional system. Next screen is 1.79.

<ESC> Returns the user to screen 1.68.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

CURRENT LIST OF FUNCTIONAL SYSTEMS
1. Hydraulics System 2. Electrical System 3. Communication System 4. Engine
select

Screen 1.78 - **Current List of Functional Systems for the system under eveluation.**

Screen 1.79 - Operational Units Per Mission Template with the name and operational unit metric displayed for each component in the Functional System.

User Actions:
From this screen, the user can use normal template editing keys and procedures to enter the number of operational units per mission for each component in the Functional system. Next screen is 1.68.

<ESC> Returns the user to screen 1.68.

PATH: MDA>MMAA>Develop Mission Scenario MODE: Work

OPERATIONAL UNITS PER MISSION		
System Name: UH-60 Black Hawk Functional System: Engine		
Component Name	Operational Unit Metric (%, rounds, miles)	Operational Units/Mission
Fuel Injection	miles	75
Cylinder Head	miles	75
Crank Shaft	miles	75
Seals, main	miles	
Master Cylinder	miles	
Battery Pack	% of mission time	

Screen 1.79 - **Operational Units Per Mission Template with the name and operational unit metric displayed for each component in the Functional System.**

3.5.6 STEP 6 - Run the Maintenance Requirements Simulation model to calculate manhour and headcount requirements, system reliability, and system availability for each maintenance scenario.

3.5.6.1 Input

<u>External:</u> None

<u>Internal:</u> The Component Maintenance Parameter file developed in Steps 1-4, the Maintenance Scenario file developed in Step 5, and the Maintenance Requirements Simulation model that is embedded within the MMAA.

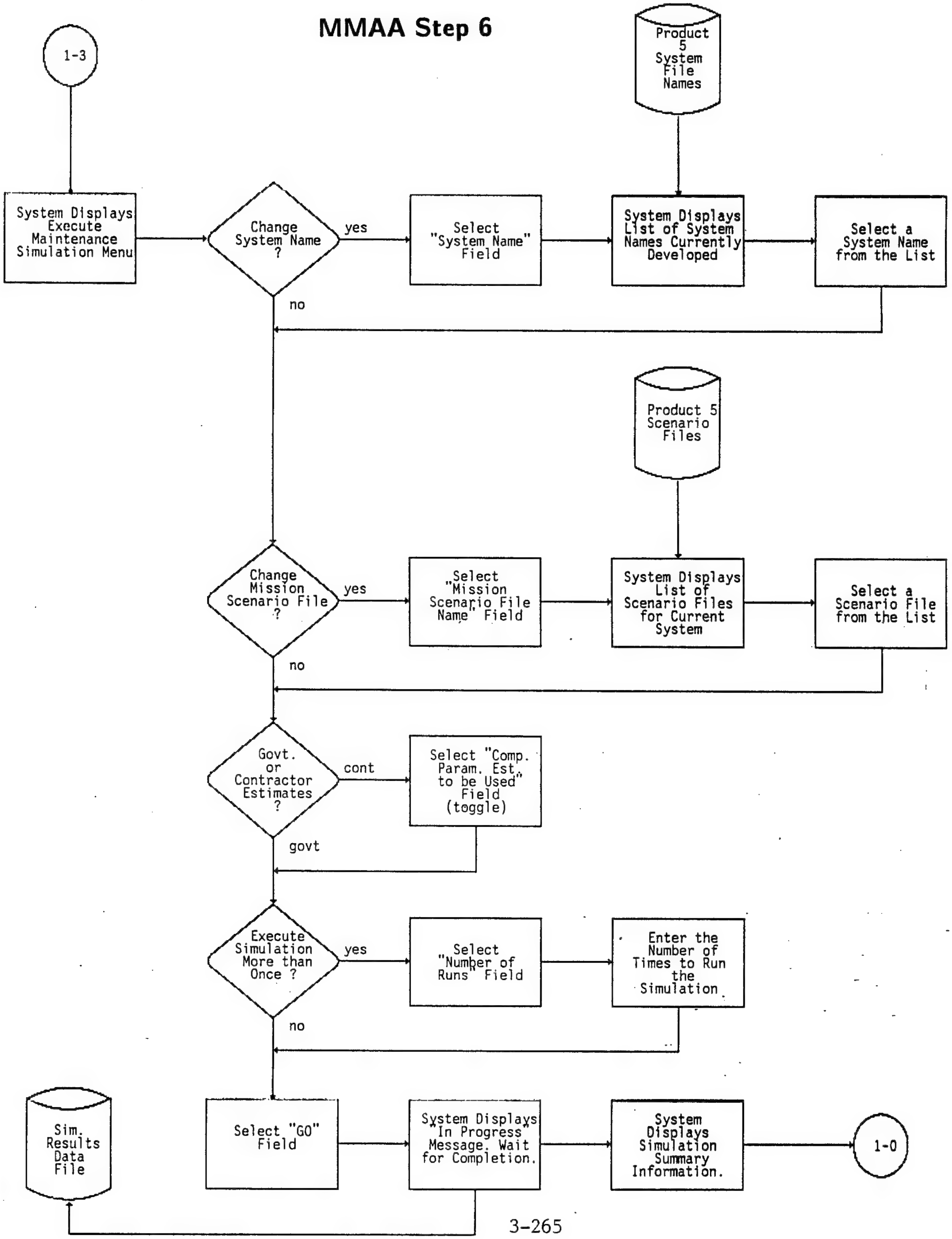
3.5.6.2 Process

When all of the Component Maintenance Parameters and Maintenance Scenario parameters have been identified for all of the Functional Systems under evaluation, the analyst can execute the Maintenance Requirements Simulation model. For each execution of the model, the analyst will be able to specify the System Name, the Maintenance Scenario file name, and whether to use government or contractor estimates for the simulation.

If any of the required input from the Component Maintenance Paraemeter or Maintenance Scenario data files is missing, incomplete or in error, the MMAA software will issue an error message and, if possible, execution will continue. If a fatal error is encountered, the execution will terminate. Each error message that is encountered will be written to an errors file for the current system and scenario name. The errors file can be viewed and/or printed out from the MDA Utilities Application.

The flow diagram of the process of performing Step 6 are included on the following page.

MMAA Step 6


1-3
Product 5 System File Names
System Displays Execute Maintenance Simulation Menu
Change System Name ?
yes
no
Select "System Name" Field
System Displays List of System Names Currently Developed
Select a System Name from the List
Product 5 Scenario Files
Change Mission Scenario File ?
yes
no
Select "Mission Scenario File Name" Field
System Displays List of Scenario Files for Current System
Select a Scenario File from the List
Govt. or Contractor Estimates ?
cont
govt
Select "Comp. Param. Est. to be Used" Field (toggle)
Execute Simulation More than Once ?
yes
no
Select "Number of Runs" Field
Enter the Number of Times to Run the Simulation
Sim. Results Data File
Select "GO" Field
System Displays "In Progress" Message. Wait for Completion.
System Displays Simulation Summary Information.
1-0

3.5.6.3 Output

The output of the Maintenance Requirements Simulation model execution is the creation of two Simulation Results data files. The Maintenance Manpower Requirements file contains maintenance manhours by:

- maintenance action
- component
- MOS/Skill Level
- maintenance level (org, ds, gs)
- maintenance type

The Maintenance Manpower Requirements file also contains an estimate of the maintenance headcount requirements.

The Mission Completion data file contains the following information:

- Missions started
- Missions completed
- Missions missed
- Missions aborted

3.5.6.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.81 - Execute Maintenance Simulation menu.

From this screen, the user can identify a system name for the model execution, select a Maintenance scenario file name, and choose to use government or contractor estimates to run the simulation model. The Execute Maintenance Simulation menu will display as defaults the currently identified System Name and Maintenance Scenario file. However, the user may execute the simulation for any System Name and Maintenance Scenario file that resides on the disk.

User Actions:

1. System Name - Lets the user choose to "type-in" or "select" a new System Name for the simulation. Next screen is 1.81A. If the System Name that the user enters is not on the working disk, an error message will display.

2. Maintenance Scenario file name - Lets the user choose to "type-in" or "select" a new Maintenance Scenario file for the next simulation. Next screen is 1.82. If the System Name that the user enters is not on the working disk, an error message will display.

3. Component Maintenance Parameter estimates to be used - Lets the user toggle between using government and contractor design estimates for the next simulation. Next screen is 1.85.

4. GO - Begins execution of the Maintenance Requirements Simulation Model. Next screen 1.86.

<ESC> Returns the user to screen 1.1.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

EXECUTE MAINTENANCE SIMULATION
1. System Name: UH-60 Black Hawk 2. Mission Scenario file name: TRANS01 3. Component parameter estimates to be used: govt. 4. GO

Screen 1.81 - Execute Maintenance Simulation menu.

Screen 1.81A - Execute Maintenance Simulation menu with the "System Name" field highlighted and the "type-in" and "select" commands displayed.

From this screen, the user can choose to type-in a new System Name for the next simulation execution or select from a list of system names currently stored on the disk.

<u>User Actions:</u>

type-in — A flashing cursor will display in a blank System name field. Next screen is 1.81B.

select — A list of System Names whose files are stored on the current working disk is displayed. Next screen is 1.81C.

<ESC> — Returns the user to screen 1.81.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

EXECUTE MAINTENANCE SIMULATION	
1. System Name: UH-60 Black Hawk 2. Mission Scenario file name: TRANS01 3. Component parameter estimates to be used: govt. 4. GO	
type-in	select

Screen 1.81A - Execute Maintenance Simulation menu with the "System Name" field highlighted and the "type-in" and "select" commands displayed.

Screen 1.81B - Execute Maintenance Simulation menu with a flashing cursor displayed in the System Name field.

<u>User Actions:</u>
Using norman editing keys and procedures, the user will enter a System Name. Next screen is 1.81. If the System Name that the user enters does not reside on the current working disk, an error message will display.

<ESC> Returns the user to screen 1.81.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

EXECUTE MAINTENANCE SIMULATION	
1. System Name: _ 2. Mission Scenario file name: TRANS01 3. Component parameter estimates to be used: govt. 4. GO	
type-in	select

Screen 1.81B - Execute Maintenance Simulation menu with a flashing cursor displayed in the System Name field.

Screen 1.81C - List of System Names whose files are saved on the current working disk.

User Actions:

Using normal menu selection procedures, the user will select a System Name from the list. Next screen is 1.81.

<ESC> Returns the user to screen 1.81.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

```
EXECUTE MAINTENANCE SIMULATIO         CURRENT SYSTEM NAMES

1. System Name:                        1. UN-60 Black Hawk
2. Mission Scenario file name: TRANS01 2. UH-1 Iroquois
3. Component parameter estimates to be 3. AH-1 Apache
4. GO                                  4. AH-1S Cobra
                                       5. M60 Tank

        type-in                    select
```

Screen 1.81C - List of System Names whose files are saved on the current working disk.

Screen 1.82 - Execute Maintenance Simulation menu with the "Maintenance Scenario file name" field highlighted and the "type-in" and "select" commands displayed.

From this screen, the user can choose to type-in a new Maintenance Scenario file name for the next simulation execution or to select a new Maintenance Scenario file for this System Name from a list of those residing on the current working disk.

<u>User Actions:</u>

type-in	A flashing cursor will display in a blank "Maintenance Scenario file name" field. Next screen is 1.82A.
select	A list of Maintenance Scenario files for the current System Name displays. Next screen is 1.83.
<ESC>	Returns the user to screen 1.81.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

EXECUTE MAINTENANCE SIMULATION	
1. System Name: UH-60 Black Hawk 2. Mission Scenario file name: TRANS01 3. Component parameter estimates to be used: govt. 4. GO	
type-in	select

Screen 1.82 - Execute Maintenance Simulation menu with the "Maintenance Scenario file name" field highlighted and the "type-in" and "select" commands displayed.

Screen 1.82A - Execute Maintenance Simulation menu with the "Maintenance Scenario file name" field highlighted and a flashing cursor displayed.

<u>User Actions:</u>

Using normal editing keys and procedures, the user will enter the name of an existing Maintenance Scenario file to be used for the next simulation model execution. Next screen is 1.81. If the file name entered does not reside on the current working disk, an error message will be displayed.

<ESC> Returns the user to screen 1.81 with the previous file name displayed.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

EXECUTE MAINTENANCE SIMULATION	
1. System Name: UH-60 Black Hawk 2. Mission Scenario file name: _ 3. Component parameter estimates to be used: govt. 4. GO	
type-in	select

Screen 1.82A - Execute Maintenance Simulation menu with the "Maintenance Scenario file name" field highlighted and a flashing cursor displayed.

Screen 1.83 - List of Maintenance Scenario files that are saved on the current working diskette for the identified System Name.

<u>User Actions:</u>

Using normal menu selection procedures, the user will select a Maintenance Scenario file from the list for the next simulation model execution. Next screen is 1.81. If the current working disk does not contain any Maintenance Scenario files for the identified System Name, a message will display.

<ESC> Returns the user to screen 1.81 with the previous file name displayed in the "Maintenance Scenario file name" field.

```
PATH: MDA>MMAA>Execute Maintenance Simulation                         MODE: Work

              ┌──────────────────────────────────────────────────────┐
              │            EXECUTE MAINTENANCE SIMULATION             │
              ├──────────────────────────────────────────────────────┤
              │                                                      │
              │  1. System Name:  UH-60 Black Hawk   ┌──────────────────────┐
              │  2. Mission Scenario file name: TRANS01 │ SCENARIO FILES FOR: │
              │  3. Component parameter estimates to be us│ UN-60 BLACK HAWK   │
              │  4. GO                                   ├──────────────────────┤
              │                                          │                      │
              │                                          │    1. TRANS01        │
              ├──────────────────────────────────────────┤    2. TRANS02        │
              │       type-in                    select  │    3. RECON01        │
              └──────────────────────────────────────────┤                      │
                                                         └──────────────────────┘
```

Screen 1.83 - **List of Maintenance Scenario files that are saved on the current working diskette for the identified System Name.**

Screen 1.85 - Execute Maintenance Simulation menu with the "Component parameter estimates to be used" field highlighted.

From this screen, the user can toggle between using government estimates of Component Maintenance Parameters for the next execution of the simulation model and using the contractor's design estimates.

User Actions:

When this field is highlighted, each time the user presses the <ENTER> key the field entry toggles between "govt." and "design". Next screen is 1.81.

<ESC> Returns the user to screen 1.1.

```
PATH: MDA>MMAA>Execute Maintenance Simulation                MODE: Work

            EXECUTE MAINTENANCE SIMULATION

   1. System Name:  UH-60 Black Hawk
   2. Mission Scenario file name: TRANS01
   3. Component parameter estimates to be used: design
   4. GO
```

Screen 1.85 - Execute Maintenance Simulation menu with the "Component parameter estimates to be used" field highlighted.

Screen 1.86 - Execute Maintenance Simulation with "Simulation in Progress" message displayed.

User Actions:

None. Next screen 1.87.

Input Files:

Component Maintenance Parameter file and Maintenance Scenario file for the identified system.

```
PATH: MDA>MMAA>Execute Maintenance Simulation                    MODE: Wait

            EXECUTE MAINTENANCE SIMULATION

  1. System Name:  UH-60 Black Hawk
  2. Mission Scenario file name: TRANS01
  3. Component parameter estimates to be used: govt.
  4. GO

                    SIMULATION
                    IN PROGRESS
```

Screen 1.86 - Execute Maintenance Simulation with "Simulation in Progress" message displayed.

Screen 1.87 - Simulation Complete summary screen.

This screen gives the user a summary of the simulation outcomes.

<u>User Actions:</u>

P Pressing this key will cause the simulation summary screen to be printed. Next screen is 1.81.

<ENTER> Returns the user to screen 1.81.

<ESC> Returns the user to screen 1.81.

PATH: MDA>MMAA>Execute Maintenance Simulation MODE: Work

SIMULATION COMPLETE
Total Maintenance Manhour Requirements: 12098 Total Number of Maintenance Jobs: 23 Total Number of Maintenance Tasks: 2203 Maximum Maintenance Headcount: 41 Simulation Errors Encountered: 0
Press <ENTER> to continue

Screen 1.87 - Simulation Complete summary screen.

3.5.7 STEP 7 - Analyze the results of the Maintenance Requirements Simulation Model execution.

In terms of the maintenance jobs that are required, the maintenance tasks that make up each job, the maintenance manhours and headcount requirements, system availability, and system reliability. These maintenance requirements are then compared to the system performance requirements identified in the Product 1 SPREA analysis and the Product 2 manpower constraints.

3.5.7.1 Inputs

<u>External:</u> The System RAM Criteria file and the Corrective Maintenance Criteria files that are an output of the Product 1 SPREA analysis and the Maintenance Manpower Constraints and Source MOS Reports that are an output of the Product 2 MCEA analysis.

<u>Internal:</u> The Maintenance Manpower Requirements file and the Mission Completion files that were produced as an output of the execution of the Maintenance Requirements Simulation Model in Step 6.

3.5.7.2 Process

The execution results of the Maintenance Requirements Simulation Model are stored in two data files that will serve as a relational data base of maintenance requirements information. A maintenance reports generator will be developed to allow the user to obtain, combine, and display or print information from the results data files in different ways.

The reports generator will produce two basic types of reports automatically that the analyst will use to determine the overall maintenance requirements for the system design. The first is a Maintenance Manhour Requirements report. This report is a table of information that lists maintenance requirements by maintenance job, maintenance action, component, maintenance organization, and maintenance type. The analyst will be able to sort and display the information in the report for any of the above categories. For example, the analyst can choose to display all of the maintenance requirements for each maintenance job or to display the maintenance requirements by component or functional system.

The second type of report that is produced automatically is the Maintenance Headcount Requirements. This report is actually a set of histograms that identify the actual numbers of people required for each maintenance job and the percentage of time that number of people were needed to maintain the system. The analyst will need both the Maintenance Manhour Requirements summary report and the Maintenance Headcount Requirements histograms to accurately evaluate the maintenance requirements for the proposed system design.

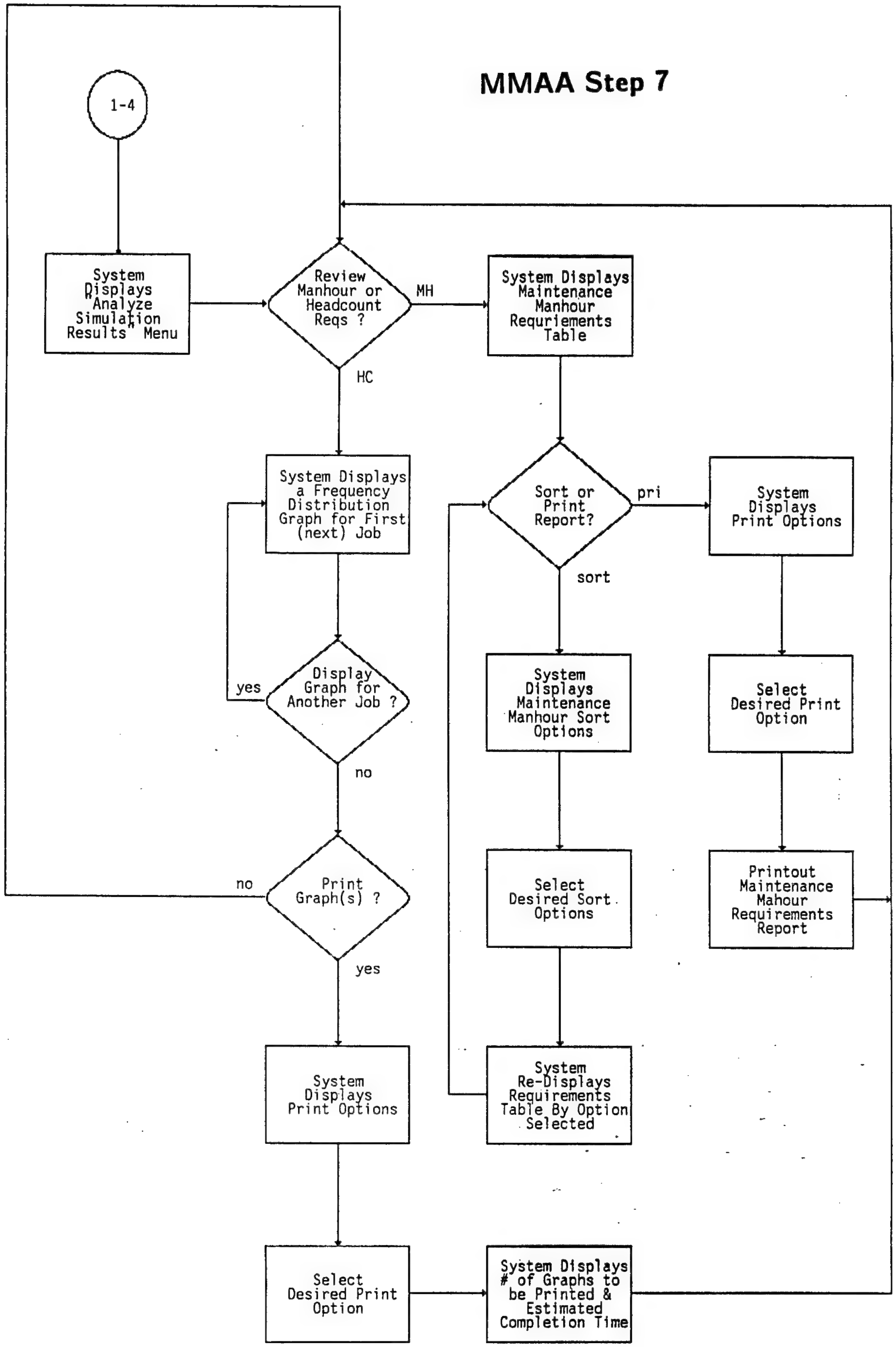
The Analyze Simulation Results portion of the MMAA software will also give the analyst an estimate of system availability and reliability based on missions missed, missions completed, and missions aborted during the simulation. The section 4 description of the algorithms used to develop the Maintenance Requirements Simulation Model contains a description of the algorithmes used to calculate availability and reliability.

The analyst will compare the output that is obtained from each execution of the model to the data contained in

the Maintenance Manpower Constraints Report and the Source MOS Report obtained from the Product 2 MCEA analysis and the performance requirements obtained from the System RAM Criteria file and the Corrective Maintenance Criteria file that were derived during the Product 1 SPREA analysis.

The flow diagram of the process of performing Step 7 are included on the following page.

MMAA Step 7


1-4
System Displays Analyze Simulation Results Menu
Review Manhour or Headcount Reqs ?
MH
HC
System Displays Maintenance Manhour Requriements Table
Sort or Print Report?
pri
sort
System Displays Print Options
System Displays a Frequency Distribution Graph for First (next) Job
Display Graph for Another Job ?
yes
no
System Displays Maintenance Manhour Sort Options
Select Desired Print Option
Print Graph(s) ?
no
yes
Select Desired Sort Options
Printout Maintenance Mahour Requirements Report
System Displays Print Options
System Re-Displays Requirements Table By Option Selected
Select Desired Print Option
System Displays # of Graphs to be Printed & Estimated Completion Time

3.5.7.3 Output

The output of this step is the identification of potential design deficiencies in terms of 1) the estimated manpower required to maintain the system as compared to the manpower constraints and 2) the estimated availability and reliability of the system as related to maintenance requirements compared to the system performance requirements determined in the Product 1 SPREA analysis.

Another output of this step is a set of maintenance reports of manhour and headcount requirments reports that can be used in the Trade-off Analysis process that will be aided by product 6 of the $(MPT)^2$ effort.

3.5.7.4 User Interface

The user interfaces that apply to this step are described in detail on the following pages. Please note that all screens for the MMAA are labeled "Screen 1.X".

Screen 1.89 - Analyze Simulation Results menu.

From this screen, the user can use normal menu selection procedures to review the stored results of the most recent Maintenance Requirements Simulation Model execution.

<u>User Actions:</u>

1. Review Manhour Requirements - Next screen is 1.90.

2. Review Headcount Requirements - Next screen is 1.92.

3. Review System Availability Estimates - Next screen is 1.106.

4. Review System Reliability Estimates - Next screen is 1.107.

5. Review Simulation Errors file - Next screen is 1.108.

<ESC> Returns the user to screen 1.1.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

ANALYZE SIMULATION RESULTS
1. Review Manhour Requirements 2. Review Headcount Requirements 3. Review System Availability 4. Review System Reliability 5. Review Simulation Errors

Screen 1.89 - Analyze Simulation Results menu.

Screen 1.90 - Maintenance Manhour Requirements report.

This report shows:

- o maintenance jobs
- o maintenance actions per job
- o the component for each maintenance action
- o the number of times the maintenance action was performed
- o the organization that performed the maintenance
- o the type of maintenance
- o the total manhours spent performing the maintenance

The Maintenance Manhour Requirements report can be sorted by any of the categories listed above and re-displayed in the new format. It can also be printed in various formats.

From this screen, the user can use arrow keys to scroll through pages of the report or access the menu bar commands to sort or print the report or to switch to view the maintenance headcount requirements.

<u>User Actions:</u>
Using the arrow keys, the user can scroll through the report.

F9 - Displays the menu bar commands. Next screen is 1.91.

<ESC> - Returns the user to screen 1.89.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

MAINTENANCE MANHOUR REQUIREMENTS						
Job (MOS/Skill)	Maintenance Action	Component Name	#	Org	Type	Total Manhours
63D10	replace	Cylinder head	3	ds	C	21.2
	repair	Fuel Injection	7	gs	C	28.0
	repair	Master Cylinder	1	gs	C	12.2
	inspect	Fuel Injection	12			9.5
	inspect	Crankshaft	38	gs	P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

Screen 1.90 - **Maintenance Manhour Requirements report.**

Screen 1.91 - Maintenance Manhour Requirements report with menu bar commands displayed.

From this screen, the user can switch to the Maintenance Headcount Requirements report, sort and display the maintenance requirements data by categories, or print the Maintenance Manhour Requirements report.

<u>User Actions:</u>

Headcount When this command is selected, the user can review the Maintenance Headcount Requirements reports. Next screen is 1.92.

sort When this command is selected the user can sort the Maintenance Manhour Requirements data by one of the defined categories. Next screen is 1.99.

print When this commanc is selected, the user can print all or portions of the Maintenance Manhour Requirements report. Next screen is 1.103.

<ESC> Returns the user to screen 1.90.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work
Headcount Sort Print
Display a headcount requirements histogram for current/selected MOS/Skill levels

MAINTENANCE MANHOUR REQUIREMENTS						
Job (MOS/Skill)	Maintenance Action	Component Name	#	Org	Type	Total Manhours
63D10	replace	Cylinder head	3	ds	C	21.2
	repair	Fuel Injection	7	gs	C	28.0
	repair	Master Cylinder	1	gs	C	12.2
	inspect	Fuel Injection	12			9.5
	inspect	Crankshaft	38	gs	P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

Screen 1.91 - **Maintenance Manhour Requirements report with menu bar commands displayed.**

Screen 1.92 - Maintenance Headcount Requirements histogram.

The histogram that displays is for the same MOS/Skill Level that is currently highlighted in the Maintenance Manhour Requirements Report. The user can page through the histograms for all of the maintenance jobs by repeatedly pressing the <ENTER> key. The user can choose to print the headcount histogram(s) or switch back to the Maintenance Manhour Requirements report by accessing the menu bar commands.

User Actions:

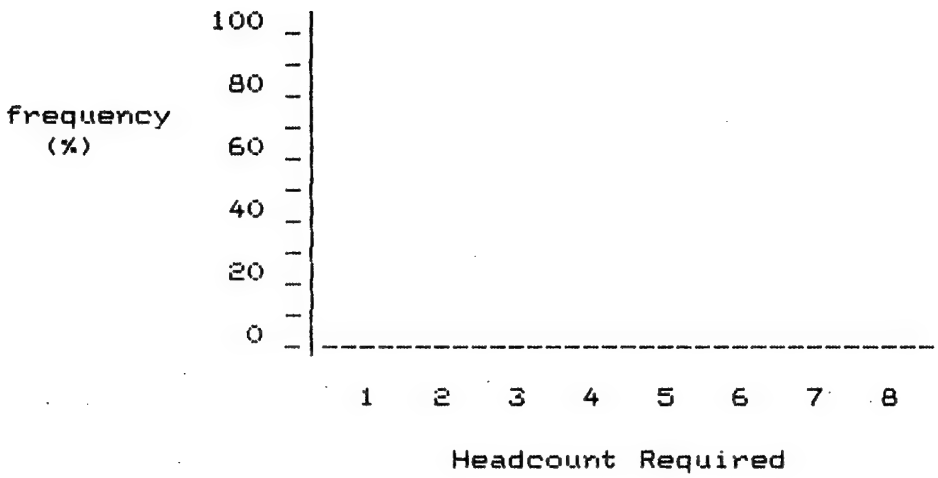
<ENTER>	Displays a headcount histogram for the next maintenance job.
F9	Displays the menu bar commands for this screen. Next screen is 1.93.
<ESC>	Returns the user to screen 1.89.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

MAINTENANCE HEADCOUNT REQUIREMENTS

MOS/Skill: 63D20

Press <ENTER> to
select a new
MOS/Skill



Screen 1.92 - Maintenance Headcount Requirements histogram.

Screen 1.93 - Maintenance Headcount Requirements histogram with menu bar commands displayed.

From this screen, the user can choose to print either the currently displayed headcount histogram, the headcount histograms for all of the maintenance jobs required for the current system or to display the Maintenance Manhour Requirements report.

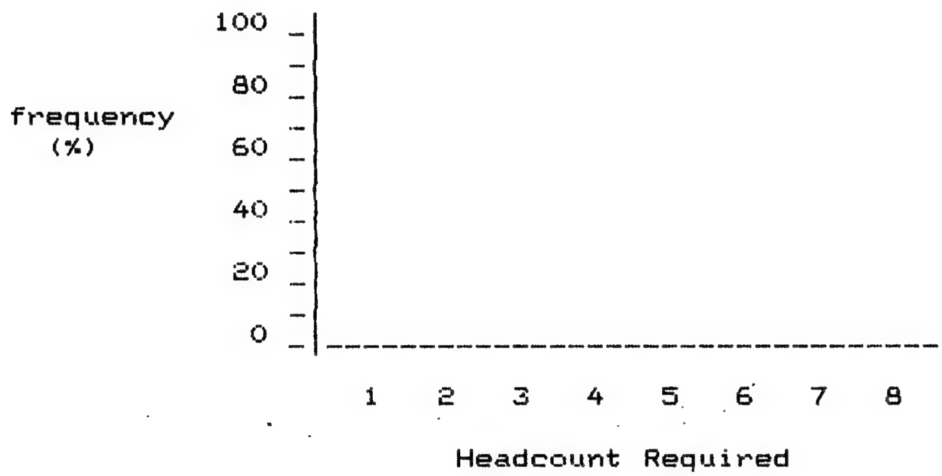
<u>User Actions:</u>

Manhours	Displays the Maintenance Manhour Requirements report. Next screen is 1.90.
Print	Displays the print menu. Next screen is 1.95.
<ESC>	Returns the user to screen 1.92.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work
Manhours Print
Display a table of maintenance manhour requirements

MAINTENANCE HEADCOUNT REQUIREMENTS

MOS/Skill: 63D20



Screen 1.93 - **Maintenance Headcount Requirements histogram with menu bar commands displayed.**

Screen 1.95 - Print Headcount Histogram(s) menu.

From this screen, the user can choose to print the currently displayed histogram or all headcount histograms.

<u>User Actions:</u>

1. For this job only - Prints only the currently displayed histogram. Next screen is 1.97.

2. For all maintenance jobs - Will print a headcount histogram for all maintenance jobs for the current system. Next screen is 1.96.

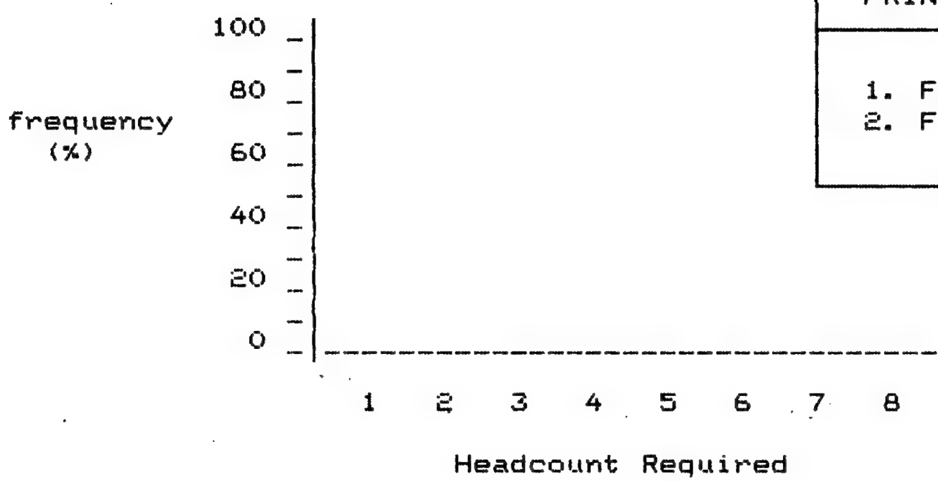
<ESC> Returns the user to screen 1.93.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work
Manhours Print
Print maintenance headcount requirements histogram

MAINTENANCE HEADCOUNT REQUIREMENTS

MOS/Skill: 63D20

PRINT HEADCOUNT HISTOGRAM(S)
1. For this job only 2. For all maintenance jobs



Screen 1.95 - Print Headcount Histogram(s) menu.

Screen 1.96 - Maintenance Headcount Requirements print message.

This is an informational message informing the user of how many histograms there are to print and the estimated completion time.

<u>User Actions:</u>

None. Next screen is 1.97.

<ESC> Aborts the printing job. Next screen is 1.96A??.

```
PATH: MDA>MMAA>Analyze Simulation Results                          MODE: Wait
  Manhours         Print
Print maintenance headcount requirements histogram

                        MAINTENANCE HEADCOUNT REQUIREMENTS

                      +------------------------------------+
                      | Currently printing all headcount   |
              100 _|  | histograms.                        |
                  _   |                                    |
               80 _   | There are 52 maintenance jobs for  |
   frequency      _   | this system, estimated completion  |
      (%)      60 _   | time: 12:15                        |
                  _   +------------------------------------+
               40 _   |        Press <ESC> to Abort        |
                  _   +------------------------------------+
               20 _
                  _
                0 _|---------------------------------

                     1    2    3    4    5    6    7    8

                          Headcount Required
```

Screen 1.96 - Maintenance Headcount Requirements print message.

Screen 1.96A - Print Job Aborted message.

Informs the user that the printing of all Maintenance Headcount Requirements histograms was aborted.

<u>User Actions:</u>
<ENTER> Returns the user to screen 1.93.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

MAINTENANCE HEADCOUNT REQUIREMENTS

PRINTING ABORTED

Press <ENTER> to continue

frequency (%)

100
80
60
40
20
0

1 2 3 4 5 6 7 8

Headcount Required

Screen 1.96A - Print Job Aborted message.

Screen 1.99 - Sort Maintenance Manhour Data menu.

From this screen, the user can choose a category by which to sort maintenance manhour data.

User Actions:

1. Maintenance Job - Sorts and displays maintenance manhour requirements by maintenance job. Next screen is 1.100.

2. Functional System - Sorts and displays maintenance manhour requirements by Functional System. Next screen is 1.100.

3. Maintenance Organization - Sorts and displays maintenance manhour requirements by maintenance organization. Next screen is 1.100.

4. Maintenance Type - Sorts and displays maintenance manhour requirements by maintenance type. Next screen is 1.100.

<ESC> Returns the user to screen 1.91.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work
Headcount Sort Print
Display maintenance manhour requirements by selected categories

MAINTENANCE MANHOUR REQUIREMENTS						
Job (MOS/Skill)	Main Ac				Type	Total Manhours
63D10	repl				C	21.2
	repa				C	28.0
	repa					
					C	12.2
	insp					9.5
	insp				P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

SORT MAINTENANCE MANHOUR DATA BY:

1. Maintenance Job (MOS/Skill)
2. Functional System
3. Maintenance Organization
4. Maintenance Type

Screen 1.99 - Sort Maintenance Manhour Data menu.

Screen 1.100 - Maintenance Manhour Requirements with "SORT OPERATION IN PROGRESS" message displayed.

<u>User Actions:</u>

None. The next screen 1.101 is an example of a Maintenance Manhour Requirements report sorted by Maintenance Organization.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Wait
Headcount Sort Print
Display maintenance manhour requirements by selected categories

MAINTENANCE MANHOUR REQUIREMENTS						
Job (MOS/Skill)	Maintenance Action	Component Name	#	Org	Type	Total Manhours
63D10	replace				C	21.2
	repair				C	28.0
	repair				C	12.2
	inspect					9.5
	inspect	Crankshaft	38	gs	P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

SORT OPERATION IN PROGRESS

Screen 1.100 - Maintenance Manhour Requirements with "SORT

Screen 1.101 - Maintenance Manhour Requirements report sorted and displayed by Maintenance Organization.

User Actions:

The user actions from this screen are the same as those for step 1.90.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

MAINTENANCE MANHOUR REQUIREMENTS						
Org	Job (MOS/Skill)	Maintenance Action	Component Name	#	Type	Total Manhours
ds	63D10	replace	Cylinder head	3	C	21.2
	63D20	repair	Rod, connecting	2	C	28.0
		remove/			C	12.2
		replace	Crankshaft	1		13.0
		repair	Engine mount	3	C	9.5
		inspect	Engine mount	27	P	13.5
		replace	Seals, main	1	C	12.5
	subtotals			* 37		* 109.9
gs	63D20	repair	Master Cylinder	1	C	12.2
		inspect	Fuel Injection	12	P	9.5
		inspect	Crankshaft	38	P	17.0

Screen 1.101 - Maintenance Manhour Requirements report sorted and displayed by Maintenance Organization.

Screen 1.103 - Print Maintenance Manhour Requirements menu.

From this screen, the user can choose to print only the information that is currently displayed on the screen, all of the information for the category highlighted in the left most column, or all of the information for the entire system.

<u>User Actions:</u>

1. This page only - Prints only the information displayed on the screen. Next screen is 1.104.

2. All requirements for the highlighted job - Prints all information for the category highlighted in the left column even if it extends beyond the current screen. Next screen is 1.104.

3. All requirements for the entire system - Prints all of the Maintenance Manhour Requirements. Next screen is 1.104.

<ESC> Returns the user to screen 1.91.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work
Headcount Sort Print
Print all or selected portions of the Maintenance Manhour Requirements table

PRINT MAINTENANCE MANHOUR REQUIREMENTS

1. This page only
2. All requirements for the highlighted job
3. All requirements for the entire system

Job (MOS/Skill)	Ma					Total Manhours
63D10	re					21.2
	re					28.0
	re					
						12.2
	inspect	Fuel Injection	12			9.5
	inspect	Crankshaft	38	gs	P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
Subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

Screen 1.103 - Print Maintenance Manhour Requirements menu.

Screen 1.104 - Maintenance Manhour Requirements menu with the "PRINTING" message displayed.

<u>User Actions:</u>

None. Next Screen is 1.105.

<ESC> Aborts the print request. Returns the user to screen 1.91.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Wait

Headcount Sort Print

Print all or selected portions of the Maintenance Manhour Requirements table

MAINTENANCE MANHOUR REQUIREMENTS						
Job (MOS/Skill)	Maintenance Action	Component Name	#	Org	Type	Total Manhours
63D10	replace	C		ds	C	21.2
	repair	F		gs	C	28.0
	repair	M				
		C		gs	C	12.2
	inspect	F				9.5
	inspect	C		gs	P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

PRINTING

<ESC> to Abort

Screen 1.104 - Maintenance Manhour Requirements menu with the "PRINTING" message displayed.

Screen 1.105 - Maintenance Manhour Requirements menu with "PRINTING COMPLETE" message displayed.

User Actions:

<ENTER> Next screen is 1.91.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

Headcount Sort Print

Print all or selected portions of the Maintenance Manhour Requirements table

MAINTENANCE MANHOUR REQUIREMENTS

Job (MOS/Skill)	Maintenance Action	Component Name	#	Org	Type	Total Manhours
63D10	replace	C			C	21.2
	repair	F			C	28.0
	repair	M				
		C			C	12.2
	inspect	F				9.5
	inspect	C			P	17.0
	remove/ replace	Seals, main	1	gs	C	12.5
subtotals			* 62			* 100.4
63D20	repair	Rod, connecting	2	ds	C	10.5
	remove/ replace	Crankshaft	1	ds	C	13.0
	repair	Engine mount	3	ds	C	9.5
	inspect	Engine mount	27	gs	P	13.5

PRINTING COMPLETE

Press <ENTER> to continue

Screen 1.105 - Maintenance Manhour Requirements menu with "PRINTING COMPLETE" message displayed.

Screen 1.106 - System Availability Estimates report.

User Actions:

P	Prints the report. Next screen is 1.89.
<ENTER>	Returns the user to screen 1.89.
<ESC>	Returns the user to screen 1.89.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

SYSTEM AVAILABILITY REPORT	
Mission: Transport Combat Troops Maintenance Scenario file: TRANS01 System Name: UH-60 Black Hawk	
Mean Time Between Component Failures:	708.8
Mean Time to Repair:	11.5
Inherent Availability:	98.4%
Press <P> to print	Press <ENTER> to continue

Screen 1.106 - System Availability Estimates report.

Screen 1.107 - System Reliability Estimates report.

<u>User Actions:</u>

P	Prints the report. Next screen is 1.89.
<ENTER>	Returns the user to screen 1.89.
<ESC>	Returns the user to screen 1.89.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

SYSTEM RELIABILITY REPORT	
Mission: Transport Combat Troops Maintenance Scenario file: TRANS01 System Name: UH-60 Black Hawk	
MISSION RELIABILITY	EQUIPMENT GROUP RELIABILITY/MISSION
Missions Started: 1515	Armament: 94%
Missions Completed: 1457	Mobility Group: 89%
Missions Aborted: 58	Communications Group: 96%
Reliability: 96%	Total System: 80.3%
Press (P) to print	Press (ENTER) to continue

Screen 1.107 - System Reliability Estimates report.

Screen 1.108 - Simulation Errors report.

User Actions:

P	Prints the report. Next screen is 1.89.
<ENTER>	Returns the user to screen 1.89.
<ESC>	Returns the user to screen 1.89.

PATH: MDA>MMAA>Analyze Simulation Results MODE: Work

SIMULATION ERRORS FILE
System Name: UH-60 Black Hawk Maintenance Scenario file: TRANS01 Errors Encountered: 1
Functional System: Engine Message: Missing (MOUBF) for (repair) (connecting rod)

Screen 1.108 - Simulation Errors report.

3.5.8 STEP 8 - Investigate potential solutions to maintenance deficiencies by modifying Component Maintenance Parameters and re-running the Maintenance Requirements Simulation Model.

3.5.8.1 Input

<u>External:</u> The contractor's design engineers, subject matter experts, analyst judgement.

<u>Internal:</u> Maintenance workload deficiencies in the system that were identified in Step 7.

3.5.8.2 Process

When the results of the Maintenance Requirements Simulation Model indicate that the manpower required to maintain the system under evaluation exceeds the manpower constraints that were identified in the Product 2 MCEA analysis or that the system availability/reliability estimates are deficient when compared to the requirements obtained from the Product 1 SPREA analysis, the analyst can use the MMAA to investigate potential solutions to the design deficiencies. The analyst can use the MMAA as a tool to estimate the effects of changes in the Component Maintenance Parameters on maintenance workload by modifying one or more parameters and re-executing the simulation model. For example, if the contractor can increase the mean time between failure for a particular component or functional system by 10%, what impact would such a change have on the system availability or reliability? This information could be presented to the contractor for potential resolution of the deficiency.

3.5.8.3 Outputs

The outputs of this Step are simulation results files that represent potential solutions to maintenance requirements deficiencies. These results files will also be available as input to the analysis aided by Product 6.

3.5.8.4 User Interface

Since the execution of this step only involves re-application of the MMAA with potentially different input data to investigate potential changes in maintenance requirements, no additional software is required.